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BY

DR. ARNOLD KNAPP OF NEW YORK AND **DR. C. HESS** OF MUNICH

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Vol. XLVIII. No. 1.

ARCHIVES OF OPHTHALMOLOGY.

THE BASIC PRINCIPLES OF DIAGNOSIS IN MOTOR ANOMALIES OF THE EYE.[1]

By Dr. ALEXANDER DUANE, New York.

OUR tests for anomalies of the ocular muscles must obviously be based on an answer to the following questions:

1. What are the normal movements of the eyes singly and in conjunction?

2. What are the possible perversions of these movements, and what distinctive evidence of its presence does each particular perversion afford?

3. What are the most ready means of bringing these distinctive evidences to light?

We may subdivide the first question into the following queries:

(*a*) What are the actions of the individual muscles of the eye?

(*b*) How are these coördinated to move each eye by itself?

(*c*) What are the coördinated movements of the two eyes acting together?

ACTIONS OF THE INDIVIDUAL MUSCLES.

The actions of the individual muscles are ascertained partly from a consideration of their anatomy, but mainly through clinical observation, particularly in cases of paralysis. Most of the facts are well known; some perhaps are yet a little in doubt.

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[1] Read by invitation before College of Physicians, Philadelphia, October, 1918.

According to my information and observation they are these:

The *external rectus* moves the eye straight out, the *internal rectus* straight in. In the nature of things the action in either case is less powerful toward the end of the movement and would seem to require reinforcement.

The *superior rectus* elevates the eye, adducts it, and intorts its vertical meridian. The elevating action in the primary position is considerable, and increases very decidedly as the eye is abducted. Theoretically it should be at its maximum when the eye is abducted 20° or so, but as a matter of clinical observation, it increases right up to the limit of movement, being at its maximum when the eye is turned far out. Similarly, it diminishes as the eye is adducted and becomes practically nil when the eye is turned well in.

The adducting and torsional actions of the superior rectus seem to vary considerably in different cases. Its torsional action offsets that of the inferior oblique, and in the primary position must be equal to it, for when the eye moves straight up its vertical meridian undergoes no tilting. Both adducting and torsional actions diminish to zero as the eye is abducted, and increase, though not greatly, as the eye is adducted.

Precisely the same is true of the *inferior rectus*. This muscle depresses the eye considerably in the primary position, and the depressing action increases continuously and fast as the eye is abducted, so that it is at its maximum when the eye is turned far out. On the other hand, it diminishes rapidly as the eye is adducted. The inferior rectus also adducts the eye and tilts its vertical meridian outward. The adducting and torsional actions, which seem to vary a good deal in different cases, diminish as the eye is turned out and increase moderately as it is turned in. The torsional action, which sometimes at least is marked, offsets that of the superior oblique and is at least equal to it in the primary position.

The *superior oblique's* main action is that of a depressor, its intorting action, upon which so much stress has been laid, its abducting action being quite subsidiary and often but little marked. In the primary position its action as a depressor is moderate—we may perhaps put it roughly as one third that of the inferior rectus—and it diminishes fast as the eye is abducted. Per contra, it increases rapidly as the eye is turned in. The contrary is true of the torsional and abducting actions, which increase, but not very fast, as the eye is turned out.

The main action of the *inferior oblique*, as we have learned from observations based on a series of complete tenotomies of the muscle, is to elevate the eye. In the primary position the amount of elevation produced by this muscle may vary from 3° to 15° of arc. At least, a deflection of this amount—or a reduction of a hyperphoria by from 5 to 25 centrads—is produced by the tenotomy. The elevating action increases fast as the eye is adducted and decreases fast when the eye is abducted. The inferior oblique also extorts and abducts the eye, particularly when the latter is already abducted. The abducting power seems not to be very great even at its maximum—at least, no marked lateral diplopia is caused by tenotomy of the muscle. The torsional effect varies. As a rule it seems to be slight or may be practically nil. I recollect only one case in which a marked torsional effect was produced by the tenotomy.

MONOCULAR MOVEMENTS.

From the foregoing statements it is clear that each eye has three abductors, the external rectus and the two obliques; three adductors, the internal, superior, and inferior recti; two elevators, the superior rectus and inferior oblique; two depressors, the inferior rectus and superior oblique; two muscles rotating the vertical meridian inward, the superior rectus and superior oblique; and two rotating the vertical meridian outward, the inferior rectus and inferior oblique. This synopsis, however, does not give a clear idea of the way in which these muscles actually coöperate in moving the eye. This is better shown by a fuller analysis.

The possible directions in which the eye can move are: straight out, straight in, straight up, straight down, up and out, up and in, down and out, and down and in. All clinical testimony shows that these movements are effected in the following way:

Movement Straight Out.—When the eye begins to move out from the primary position, the external rectus receives a strong stimulus and, according to Sherrington's law, the internal rectus is inhibited and relaxes. At the same time that the external rectus receives its extra stimulus, all the other muscles except the internal rectus are stimulated too. The superior and inferior recti pulling, the one up and the other down, balance each other in vertical action, so that the eye does not swerve from its horizontal path but is kept steadily in it by the counteracting tension of the two muscles. Both muscles act to oppose each other in torsional action, so that the vertical meridian is held vertical. Both muscles combine to adduct the eye, so as to oppose to a moderate degree the outward movement, and doubtless by their steady pull prevent its taking place too suddenly or jerkily. The two obliques also counteract each other, so far as torsional and vertical actions are concerned, and thus also act to steady the eye in its course and prevent it from swerving up or down or from tilting to right or left. Both abduct the eye and so reinforce the action of the external rectus. In this stage of the movement their abducting action is in general about neutralized by the adducting action of the superior and inferior recti. The net result is that at the beginning of the outward movement the eye is abducted strongly by the external rectus, which is then acting at a considerable mechanical advantage, and it is simply steadied in its course by the action of the other four muscles; the superior and inferior recti, in particular, having the important effect of checks or brakes to prevent the abduction from going on too suddenly.

As the movement progresses the external rectus acts at a greater mechanical disadvantage, and, moreover, is now opposed by the increasing passive pull of the lengthening and tightening internal rectus. If these two muscles alone were acting, the outward movement would be slowed up and impeded. But, as an offset to the diminishing power of the external rectus, the abducting action of the obliques now comes more and more into play, since their action in this regard increases as the eye is abducted, and, what is more important, the counteracting adducting action of the superior and inferior recti falls off altogether. The result is that when the eye has been turned out some 30° it is carried further out not only by the external rectus, which now acts somewhat less effectively than before and begins to feel the opposing pull of the stretched internal rectus, but also by the obliques, whose abducting action is constantly increasing and is no longer opposed by the counteracting pull of the internal and superior recti. The eye is now kept straight in its path solely by the superior and inferior recti, which act simply to elevate and depress the eye and whose opposing vertical actions keep pace with each other as they steadily increase. On the other hand, the vertical meridian is kept vertical solely by the opposing, equal torsional action of the two obliques.

Movement Straight In.—Quite a similar coöperation of muscles obtains in inward movement. At the outset of the movement the external rectus is inhibited and relaxed and all the other muscles receive an extra stimulus. The internal rectus, acting at a considerable mechanical advantage, moves the eye strongly inward, excessive and jerky movement being prevented by the counteracting pull of the subsidiary abductors, *i.e.*, the superior and inferior obliques. The inferior and superior recti, on the other hand, by their adducting action, which about balances the abducting action of the obliques, reinforce the inward movement. The eye is kept from swerving up or down and the vertical meridian is kept vertical by the combined and opposing actions of the superior and inferior recti and the obliques.

When the eye is turned well in, the internal rectus, acting now at some mechanical disadvantage, is opposed mainly by the passive pull of the stretching external rectus, since the abducting power of the obliques has now become nil; and it is sensibly reinforced by the steadily increasing adducting action of the superior and inferior recti. The eye is kept from swerving up or down solely by the obliques, and its vertical meridian is kept vertical solely by the superior and inferior recti.

Movement Straight Up.—When the eye is moved straight up, the inferior rectus and superior oblique are inhibited and relaxed, and the other four muscles are stimulated. The eye is carried up by the combined action of the superior rectus and inferior oblique, the former predominating. The lateral actions of these muscles oppose each other and tend to keep the eye steady in its upward course. The like is true of the external and internal recti, which contract strongly and by their equal, opposing actions keep the eye from swerving to the right or left. The vertical meridian is kept vertical by the counteracting torsional actions of the superior rectus and inferior oblique.

Movement Straight Down.—Similarly, in a movement straight down the superior rectus and inferior oblique are relaxed, and the eye is carried down by the inferior rectus and superior oblique. The abducting and adducting actions of the latter muscles counteract each other, as do the abducting and adducting actions of the external and internal recti, so that the eye is kept from swerving to right or left as it goes down. Moreover, as the torsional actions of the inferior rectus and superior oblique nullify each other, the vertical meridian is kept vertical.

Movement Up and Out.—When the eye moves up and out, the internal rectus, inferior rectus, and superior oblique are relaxed. The eye is carried out by the external rectus, the movement being opposed at first by the superior rectus and reinforced by the inferior oblique. As the eye goes further out, and the opposing action of the superior rectus falls away, the reinforcing action of the inferior oblique increases, so that the outward movement is hindered only by the passive pull of the stretching internal rectus. At the beginning of the movement the eye is carried up by both the superior rectus and inferior oblique, but soon the latter ceases to act, and the superior rectus alone elevates the eye. The vertical meridian, at first really vertical, later becomes tilted outward, since the increasing torsional action of the inferior oblique is now unopposed by the superior rectus, which is acting solely as an elevator.

Movement Up and In.—When the eye moves up and in, the external rectus, inferior rectus, and superior oblique are relaxed. The eye is carried in by the internal rectus, the movement being opposed by the inferior oblique and reinforced by the superior rectus. As the eye goes further in, the reinforcing action of the superior rectus increases and the opposing action of the inferior oblique falls away, so that the inward movement is opposed only by the passive pull of the lengthening external rectus. The eye is carried up at first by the superior rectus and inferior oblique together, later by the oblique alone. The vertical meridian is tilted in, because the increasing torsional action of the superior rectus predominates more and more over the decreasing torsional action of the oblique.

Movement Down and Out.—When the eye moves down and out, the internal rectus, superior rectus, and inferior oblique are relaxed. The eye is carried out by the external rectus, assisted more and more by the superior oblique and counteracted to a decreasing extent by the inferior rectus. It is moved down at first by both inferior rectus and superior oblique, later by the former muscle alone. Its vertical meridian is tilted in by the increasingly predominant torsional action of the superior oblique.

Movement Down and In.—When the eye moves down and in, the external rectus, superior rectus, and inferior oblique are relaxed. The eye is carried in by the internal rectus, assisted more and more by the inferior rectus and counteracted to a decreasing extent by the superior oblique. The eye is carried down at first by both inferior rectus and superior oblique, later by the superior oblique alone. The vertical meridian is tilted outward by the increasingly predominant torsional action of the inferior rectus.

We see therefore that movements straight out and straight in are effected by the coöperation of five muscles; movements straight up and straight down by the coöperation of four; and oblique movements by the coöperation of three. Furthermore, it is only in movements straight up and straight down that the muscles exert a constant form of action throughout the eye's excursion. In lateral and oblique excursions, the actions of all the muscles involved except the internal and external recti keep changing in character as the eye advances. It is owing to this fact that the two lateral and four oblique, but not the two vertical directions of the gaze, afford distinctive evidences of the nature of the trouble when any given muscle is paralyzed or overacting. Since these two lateral and four oblique directions of movement are the only ones of diagnostic importance, they are denominated the *cardinal directions of the gaze* (see infra).

BINOCULAR MOVEMENTS.

What, however, as clinicians we are really concerned with is not the muscles nor even the movements of either eye alone, but the coördinated movements of both eyes together. It is important to remember this fact, as it constitutes the basis of both our tests and our treatment.

The binocular movements that we have to consider are:

(*a*) Parallel or conjugate movements.
(*b*) Convergence.
(*c*) Divergence.

The other possible coördinated movements of the eyes are clinically of small importance.

Conjugate Movements.—For purposes of diagnosis it is convenient to divide the conjugate movements into movements to the right, left, up and right, up and left, down and right, and down and left. Corresponding to these six cardinal directions of the gaze are six pairs of muscles, each pair having a distinct field of action in which it is predominant, so far at least as its main action (abduction, adduction, elevation, or depression) is concerned. Thus we have the following:

Field of Action	*Muscles Predominant in Field*	
Right	R. external rectus	L. internal rectus
Left	R. internal rectus	L. external rectus
Up and right	R. superior rectus	L. inferior oblique
Up and left	R. inferior oblique	L. superior rectus
Down and right	R. inferior rectus	L. superior oblique
Down and left	R. superior oblique	L. inferior rectus

We thus see that the twelve muscles of the two eyes are divided into six pairs of associates. Thus the superior rectus of the right eye is the associate of the inferior oblique of the left. Now it must be emphasized as the basis of all of our tests of coördinate movements that of the two muscles constituting a pair of associates either one will carry its eye as far and as fast in any given direction as the other member of the pair will carry the fellow eye, and that, further, each pair of associates has as its field of predominant action one of the six cardinal directions of the gaze, which belongs to it and to it alone.

Convergence.—Convergence is effected by an equal simultaneous contraction of both interni, due to an impulse that emanates from a center distinct from that which causes a conjugate movement of either eye inward. This distinction between convergence-adduction and conjugate-adduction is of great importance in the diagnosis of motor anomalies.

Divergence.—Divergence is effected by a simultaneous equal relaxation of both interni, associated in all probability with an active contraction of both externi.

VARIETIES OF MOTOR ANOMALIES.

A motor anomaly consists of some perversion of a coordinate movement. We have therefore as the fundamental varieties of motor anomalies:

(*a*) Affections of conjugate movements.
(*b*) Affections of convergence.
(*c*) Affections of divergence.

Affections of Conjugate Movements.—The affections of conjugate movements comprise:

1. Those located in the muscles themselves or in the nerves and nerve nuclei directly supplying them. These include:

Muscular insufficiency (in the proper sense of the term).
Paralysis and spasm of the individual muscles.

2. Those located in the centers presiding over conjugate movements and their connections. These include:

Conjugate paralysis and spasm.
Nystagmus.

The characteristic mark of a muscular insufficiency, paralysis, or spasm is that, since some individual muscle is under- or over-active, the affected eye will fall behind or shoot ahead of the other when the two enter the field of action of the muscle concerned, *i.e.*, when they attempt to look in a certain one of the six cardinal directions of the gaze. This will be evidenced by a visible lagging of one eye, a corresponding deviation shown by the screen and other tests, and by diplopia—all these symptoms increasing progressively as the eyes are carried in a given direction.

The characteristic mark of a conjugate paralysis or spasm or of nystagmus is the presence of a bilateral equal deflection of the eyes from the primary position or a bilateral and equal restriction of movement.

Affections of Convergence.—Affections of convergence comprise:

Convergence-excess.

Convergence-insufficiency.

Their characteristic mark is a deviation which increases as the object looked at is approximated to the eyes, but which does not increase as it is carried to the right or left.

Affections of Divergence.—Affections of divergence comprise:

Divergence-excess.

Divergence-insufficiency.

Their characteristic mark is a deviation which increases as the object is carried away from the eyes and which does not increase as the object is carried to the right or left.[1]

Mixed Conditions.—We very often find mixed conditions, including:

Convergence anomalies with consecutive divergence anomalies.

Divergence anomalies with consecutive convergence anomalies.

Either the one or the other, singly or combined, associated with muscular insufficiency, paralysis, or spasm.

These various pathological conditions, simple and mixed, we usually group under the two heads of heterophoria and squint. These two are often regarded as quite distinct in nature, but according to my belief and experience there is no essential difference between them. It is true that the symptoms, prognosis, and treatment differ somewhat, but this, I am sure, is due simply to the fact that ordinary squint represents a later and more complex stage of the process, of which heterophoria is the first and simplest expression—the two conditions themselves being in fundamentals the same.

Types of Heterophoria.—The heterophorias comprise esophoria, exophoria, and hyperphoria.

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[1] Provided that in carrying the object to the right or left the angle subtended by the two visual lines remains the same. This requires that the object should be carried to the right or left along the circumference of a horopteric circle, *e.g.*, round the circumference of a horizontal hoop, the near part of which is held in contact with the root of the patient's nose.

The *esophorias* that we ordinarily encounter are cases of convergence-excess, which may be complicated by a consecutive divergence-insufficiency. In a small minority of the cases they are due to a primitive divergence-insufficiency or to actual weakness of the externi.

About two thirds of the cases of *exophoria* are due to convergence-insufficiency, complicated quite often with a consecutive divergence-excess. In one third of the cases, divergence-excess is the primary condition. Quite often such a primary divergence-excess persists indefinitely without increase or complication. In other cases it is followed sooner or later by a convergence-insufficiency. The distinction between the two types is important, as their treatment differs. Moreover, the more the element of convergence-insufficiency enters into the condition, the more marked usually are the symptoms.

The *hyperphorias* are probably in almost all cases due to insufficiency or actual paresis of the individual muscles. Exception may be made of certain cases of hyperphoria, sometimes considerable in amount, occurring as the result of wearing prisms or ill-fitting glasses which act like prisms. In this case the hyperphoria is due to an active spasmodic divergence of the eyes in a vertical plane.

Types of Squint.—Squint develops out of a heterophoria or a paresis. As already intimated, this statement is counter to the belief of many, who hold that squint and heterophoria are basically different and that the former is not the outcome of the latter. But all my experience indicates the correctness of the view enunciated.

According to this, the *usual type of the convergent squint* of childhood starts as an esophoria due to accommodative convergence-excess. This esophoria is gradually converted into a squint, at first intermittently periodic, then constantly periodic, and finally continuous. Later still, changes take place in the muscles themselves (actual weakening of the externi, contracture of the interni), aggravating the squint and rendering its cure more difficult.

So, too, the *usual type of a divergent squint* starts as an exophoria due either to a convergence-insufficiency, usually accommodative in origin, or, in a fair proportion of cases, to a divergence-excess. The deviation, as in the case of a convergent squint, passes through the successive stages of a heterophoria, a periodic squint, a continuous comitant squint, and finally a squint no longer strictly comitant because it is complicated by consecutive muscle changes.

As against these, which constitute the great majority of cases of squint, must be set two other types. First, there are the *paretic squints*, of which the congenital squints of childhood compose a specially important variety. Of these latter there are various forms, but two in particular deserve attention. One is the peculiar syndrome characterized by complete inaction of the externus, restricted action of the internus in the same eye, and retraction of the eyeball and narrowing of the palpebral fissure in adduction, with often an upshoot of the inturning eye. This is rather rare. Much more frequent and important is the congenital paresis of the superior rectus, associated in most cases with upshoot of the other eye in adduction, due to overaction of its inferior oblique.

The third variety of squints is the *mixed type*, in which a congenital paresis, especially one of the sort just mentioned, is followed by a gradually developing convergent or divergent squint. The lateral deviation in this case is not only consecutive to the vertical deflection, but is evidently dependent upon it. These cases are fairly numerous and are important, since their treatment demands that the vertical deviation shall be made out and shall be remedied by operation before any effective treatment can be applied to the lateral squint. I have seen several cases in which neglect of this fact has produced disappointing results. On the other hand, if the vertical deflection is removed, to start with, the lateral squint may disappear of itself.

TESTS TO BE USED AND WHAT THEY DETERMINE.

The tests used in order to make the diagnosis may be very simple, if we have regard to the facts just enunciated concerning the physiology and the pathology of the eye movements. Our tests, in fact, have a twofold object: first, to determine whether any deviation present is due to an anomaly of conjugate movement, convergence, or divergence, or represents a mixed condition; and, second, to ascertain how far and under what conditions this deviation impairs the ability of the two eyes to move in harmony and to see as one. In determining the first point we must in particular ascertain whether the deviation increases in any special direction of the gaze or increases in convergence or in divergence. My own procedure is as follows:

1. First, I determine by the screen test, parallax test, and phorometer the *amount and kind of deviation for distance and near*. The screen test at the same time discloses whether the deviation is a heterophoria or a squint and, if the latter, whether it is alternating or monocular and whether it is comitant or intermittent.

If the deviation is notably greater for distance than for near, we should infer that it is mainly due to a divergence anomaly (to a divergence-excess if it is an exophoria, divergence-insufficiency if it is an esophoria). This inference will be confirmed if it turns out that the deviation does not increase in looking to the right or left.

If the deviation is notably greater for near than for distance, we are in general dealing with a convergence anomaly (convergence-excess, if it is an esophoria, convergence-insufficiency,[1] if it is an exophoria).

If the deviation is the same for distance and near we are dealing with a mixed condition.

2. I determine the *prism-divergence* for distance, *i.e.*, the ability to overcome prisms, base in, when the patient is looking at an object across the room. If this is high (nine centrads or over) we would infer a divergence-excess (primitive or consecutive); if it is low (below three centrads or actually negative[2]) we should infer a divergence-insufficiency. The diagnosis in either case would be confirmed if the deviation did not increase in looking to the right or left.

3. I determine the *convergence near-point*, measuring it in the way I have elsewhere described[3] from the base-line con-

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[1] Some cases of moderate weakness of the interni when associated with good converging power may give a marked exophoria for near. These cases are marked by the fact that the convergence near-point is not remote as it is in a true convergence-insufficiency (see infra).

[2] That is, if there is homonymous diplopia.

[3] ARCH. OF OPHTH., xliii., No. 5, p. 476.

necting the centers of rotation of the two eyes. If the near-point is remote (over 100*mm* from the base-line) we argue the presence of a convergence-insufficiency.

It will be noted in some cases of divergent squint that the patient, while never actually converging so that both eyes fix the approximating object, yet makes a strong effort to do so, the eyes turning in more and more as the object is brought closer, until some comparatively near-point is reached, when the effort is given up. The presence of such a *relative near-point of convergence* should be noted, as when close it indicates good converging power and makes the outlook for operative or other treatment more favorable.

The presence of a low degree of exophoria for near with a remote convergence near-point indicates a marked convergence-insufficiency, while a high degree of exophoria for near with a comparatively close convergence near-point rather indicates a moderate weakness of the internal recti associated with high converging power.

4. I note the *excursions of the two eyes* when they are following a light-colored pin carried in each of the six cardinal directions of the gaze, observing whether one lags behind the other or shoots ahead of it when the latter is fixing. This test is advantageously made first with both eyes following the object; afterward, with one eye following and the other screened in such a way that the observer can see its action behind the screen.

This test I often supplement by determining the *screen-deviation in each of the six cardinal positions*, a dot on a card being used in this case as the object of fixation; and, if diplopia is present, by mapping this on the *tangent-curtain* in each of the six positions.

These excursion and diplopia tests enable us at once to say if there is any affection of the conjugate movements (*i.e.*, any insufficiency, paresis, or spasm of the individual muscles), and to ascertain the muscle involved. For, if one eye follows the other without sensible lagging in each of the six directions and if the deviation, vertical or lateral, does not increase notably in any one of the six, then the deviation is comitant and must be due almost certainly to a convergence or divergence anomaly. Exception may be made of certain cases of old paretic squint in which through contractures of the muscles or other complicating factors the picture of a comitant deviation is simulated.

On the contrary, if in any one of the six cardinal directions of the gaze one eye lags behind the other, or one eye when screened shoots ahead of its fellow which is fixing, or the screen deviation increases, or diplopia develops and grows progressively greater, we are dealing with a paresis or spasm of one of the two muscles constituting the pair of associates, whose field of action lies in that particular direction of the gaze.

The diagnosis of the special muscle affected can be made almost at a glance. The following table is as convenient as any for the purpose:

Lagging, Deviation, or Diplopia Increasing	*Character of Diplopia or Deviation*	*Muscle Affected*
To right	Homonymous Crossed	R. external rectus L. internal rectus
To left	Homonymous Crossed	L. external rectus R. internal rectus
Up and right	L. hyperphoria R. hyperphoria	R. superior rectus L. inferior oblique
Up and left	R. hyperphoria L. hyperphoria	L. superior rectus R. inferior oblique
Down and right	R. hyperphoria L. hyperphoria	R. inferior rectus L. superior oblique
Down and left	L. hyperphoria R. hyperphoria	L. inferior rectus R. superior oblique

In using this or any similar table there are several facts to be borne in mind.

(*a*) To make from it a sure diagnosis of insufficiency or paresis, the deviation, lagging, or diplopia must increase decidedly and progressively as the eyes are carried in the given direction. The more rapid the increase, the more marked the paresis.

(*b*) Theoretically, paresis of the superior or inferior rectus should be associated with crossed diplopia or deviation, and paresis of an oblique with homonymous deviation. But the adducting power of the superior and inferior recti and the abducting power of the obliques are so feeble that the lateral diplopia due to paresis of these muscles is often neutralized or reversed by a diplopia due to other causes. Even in this case, however, the paresis causes the diplopia to change in a characteristic way. Take, for example, a paresis of the right superior oblique associated with a marked convergence-insufficiency. The crossed diplopia due to the latter may completely neutralize the homonymous diplopia due to the paresis of the oblique. But in this case the crossed diplopia, instead of remaining the same when the eyes are swung from left to right, as it would do if caused by an uncomplicated convergence-insufficiency, diminishes as the eyes are carried to the right and increases as they are carried to the left, because in the former position it is more and in the latter position it is less neutralized by the changing homonymous diplopia due to the paresis of the oblique.

An analysis of all possible cases gives the following interesting laws, which I enunciated a number of years ago.

An homonymous diplopia (or deviation) increasing to the right[1] indicates a paresis of one (and it may be any one) of the six muscles of the right eye[2]; or it may indicate a spasm of any one of the six muscles of the left eye. If the increase is rapid it indicates a paresis of the right external rectus.

A crossed diplopia (or deviation) increasing to the right indicates a paresis of some one of the six muscles of the left eye; or it may indicate a spasm of some one of the six muscles of the right eye. If the increase is rapid, it indicates a paresis of the left internal rectus.

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[1] Obviously the converse of this is true; *i.e.*, in this and the succeeding propositions "left" may be substituted for "right," and vice versa.

[2] For an homonymous diplopia increasing to the right may be due to paresis of an abductor whose abducting action increases to the right (right external rectus, right superior oblique, right inferior oblique) or to a condition causing a preponderating comitant homonymous diplopia combined with paresis of an adductor whose adducting action diminishes to the right (right internal rectus, right superior rectus, right inferior rectus). But since the external rectus is the only muscle that produces marked abduction and since to the right of the median line the three adductors of the right eye act very feebly, a *marked* increase in the homonymous diplopia in looking to the right must be due to paresis of the external rectus.

(*c*) An homonymous diplopia due to a convergence or divergence anomaly or to a paresis of a lateral rotator naturally tends to increase as the eyes are directed down, and diminish as the eyes are directed up, while the reverse is true of a crossed diplopia. Hence a crossed diplopia that increases in the upper field or even one that is confined to the upper field or to a corner of it is not per se evidence of paresis of an elevator; nor is an homonymous diplopia that is similarly confined to the lower field evidence of paresis of a depressor.

5. In squint cases I determine with the amblyoscope, bar reading, or the red glass, whether the patient has *binocular vision*, and how far he can get and maintain *fusion*. In doing this I try to determine to what extent he suppresses one image. Suppression may be partial, as when a patient fails to recognize the diplopia produced by prisms or a red glass, but can recognize the diplopia produced by the amblyoscope. Or he may recognize the diplopia produced by prisms only when the latter are of such a strength as to approximate or separate the images by a certain amount.

Such are the main tests I use. In some particularly obscure cases we may have to apply *other tests* with special refinements, but these are very rarely necessary. The reverse is much more often true; *i.e.*, we can make a diagnosis *without employing even all the tests* above given. In very young children with comitant or paretic squint, we can usually determine the kind and amount of deviation and the muscles affected by making the simple excursion test in the six cardinal directions of the gaze and by making the screen test for distance and near in the primary position—getting the child to fix for a moment on a tiny bright light, a well-defined toy, or any other object that may serve to hold its attention. The diagnosis can be made in this way in a child of eight months. In older patients we should in addition to these tests determine the convergence near-point, the degree of binocular vision with the amblyoscope, and, if double vision is present, the field of diplopia on the tangent-curtain.

I cannot emphasize too strongly the importance, particularly in squint cases, of the screen and excursion tests. These alone, properly made, will show in a few minutes whether we are dealing with a heterophoria or a squint, whether the deviation is due mainly to a divergence or convergence anomaly, or to a mixture of both, whether it is alternating or monocular, constant or intermittent, periodic or continuous; and finally whether it is strictly comitant, whether it is comitant but complicated by an insufficiency or paresis of an individual muscle, or whether it is strictly paretic. If the deviation is paretic, these same tests disclose the muscle or muscles affected.

Whether we follow precisely the methods above given or not is doubtless immaterial. But we must, at all events, pursue some such systematic scheme as this, based on the physiological factors involved, or we shall fail to interpret the case aright and shall not be in position to undertake a rational plan of treatment.

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ILLUSTRATING DR. COHEN'S ARTICLE ON "PRIMARY INTRADURAL TUMOR OF THE ORBITAL PORTION OF THE OPTIC NERVE."

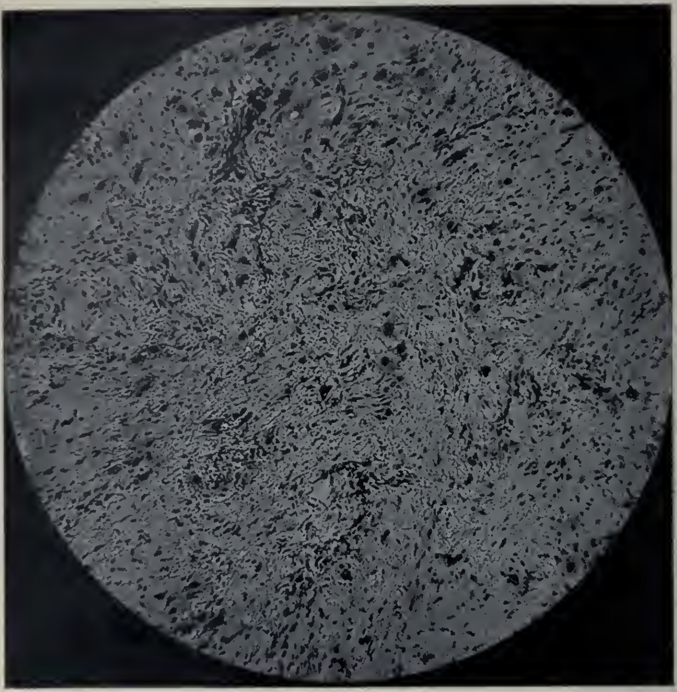

FIG. 1. Low power appearance of ganglion cells and hyperplasia of neuroglia tissue.

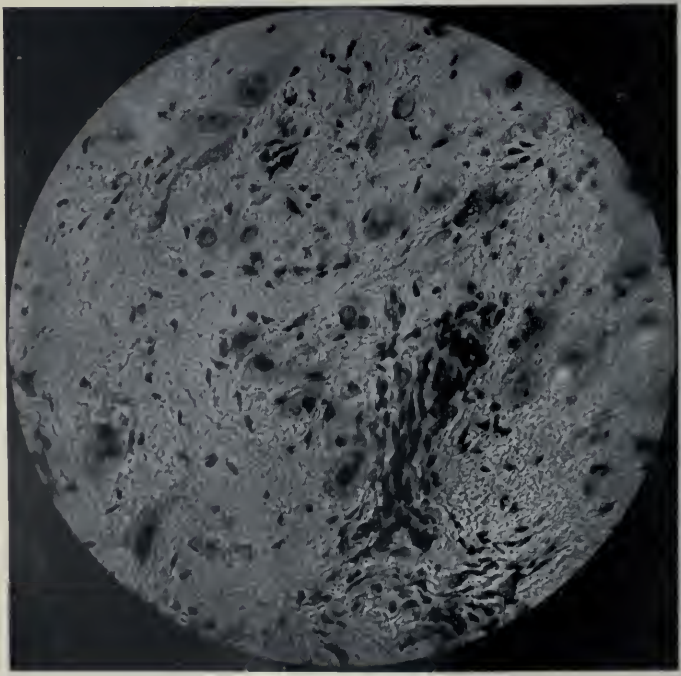

FIG. 2. Same as Fig. 1, under higher power.

PRIMARY INTRADURAL TUMOR OF THE ORBITAL PORTION OF THE OPTIC NERVE.[1]

By Dr. M. COHEN, New York.

(*With four illustrations on Text-Plates I. and II.*)

Miss R. C., age 18, parents died of tuberculosis. They left two children, the patient being one, the other a brother who is at present in the U. S. Army. The previous history is negative, except for complaints of frequent and severe headaches for several years. The patient is moderately under-sized, well nourished, intelligent, but apathetic. Her main symptom is increasing protrusion of the eye and marked disturbance of the vision, of the left eye. The protrusion she states has existed as long as she can remember. The vision also has been poor for a long time, and has been absolutely lost for the past six months.

Dr. Troncoso first saw the patient a month and a half ago, when he made the diagnosis of optic nerve tumor. The patient was admitted to the Post-Graduate Hospital on September 1st. A complete physical examination—including a neurological report, differential blood count, blood Wassermann, rhinological examination, and X-ray examination of the skull—was normal. General tuberculin reaction test was not considered advisable. The eye report before operation was as follows:

Right eye: external examination normal; vision equal to $\frac{20}{20}$; fundus normal. Left eye: vision nil, and without any direct pupillary reaction. The pupil was slightly dilated, circular and central. The eyeball was markedly exophthalmic, but without any inflammatory symptoms. The palpebral fissure was slightly widened. The eyeball was displaced straight forward, with no loss of ocular motility in any direction. Palpation of eyeball met with an elastic resistance. The fundus examination showed solely a post-neuritic optic atrophy; the retinal vessels were normal.

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[1] Presented before Section on Ophthalmology, New York Academy of Medicine, Oct. 21, 1918.

From these clinical facts the diagnosis of tumor of the optic nerve was made.

The Kroenlein operation was advised, only to conserve the eye and reduce the exophthalmos. It was consented to by the patient and relatives. Enucleation was considered but not suggested, as the size and nature of the tumor were unknown. The usual operation was performed. After access to the apex of the orbit, a mass was palpated with the small finger. This mass was large, smooth, globular, and boggy, and extended from about 6*mm* from the eyeball to about 3*mm* from the optic foramen. After the surrounding tissues were retracted, the tumor could be seen, readily. Deep catgut sutures were then passed around the apparently normal optic nerve, at both extremities, and then, with curved scissors, both extremities were cut on the tumor side. At the optic foramen end, the tumor was cut into slightly. The suture was then gently drawn out, and the optic nerve of normal caliber was cut. Both specimens were then fixed in formalin solution.

Unfortunately the small optic nerve section from the optic canal was misplaced. Five weeks after the operation, the general condition is the same; the headaches are still evident. The eye examination is as follows:

Right eye: vision equals $\frac{20}{30}$, corrected to $\frac{20}{20}$. External appearance, normal. The field of vision with the perimeter and using 10*mm* white and colored squares shows a marked concentric contraction, the visual field measuring from 18 to 20 degrees around the fixation point. This condition probably existed before the operation, and is difficult to explain satisfactorily unless one considers it of congenital or hysterical origin. The left or operated eye shows the following condition: Complete ptosis; no exophthalmos. The position of eyeball is up and out and practically stationary, only slight lateral motility existing. There is a moderate chemosis of the lower fornix. The entire eyeball is anæsthetic. The pupil is irregular and the cornea is transparent. Considering these results at present, enucleation, from a cosmetic standpoint, would have been advisable. The fundus shows marked alterations which are of unusual interest. The disk is pinkish in color with its margin completely obliterated. The main retinal veins have a straight course, are dilated, and filled with light-colored blood, except in the periphery, where the vein becomes gradually empty. The retinal arteries are normal in character. Their central light reflex is prominent; at places they are interrupted, due to retinal exudates. The

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ILLUSTRATING DR. COHEN'S ARTICLE ON "PRIMARY INTRADURAL TUMOR OF THE ORBITAL PORTION OF THE OPTIC NERVE."

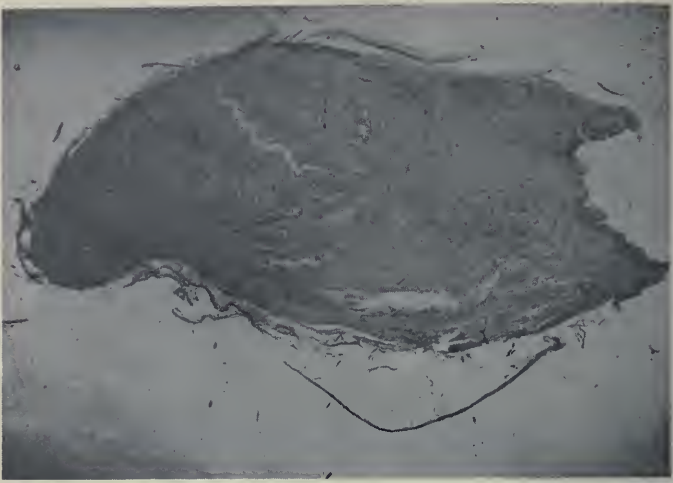

FIG. 3. Gross appearance of tumor.

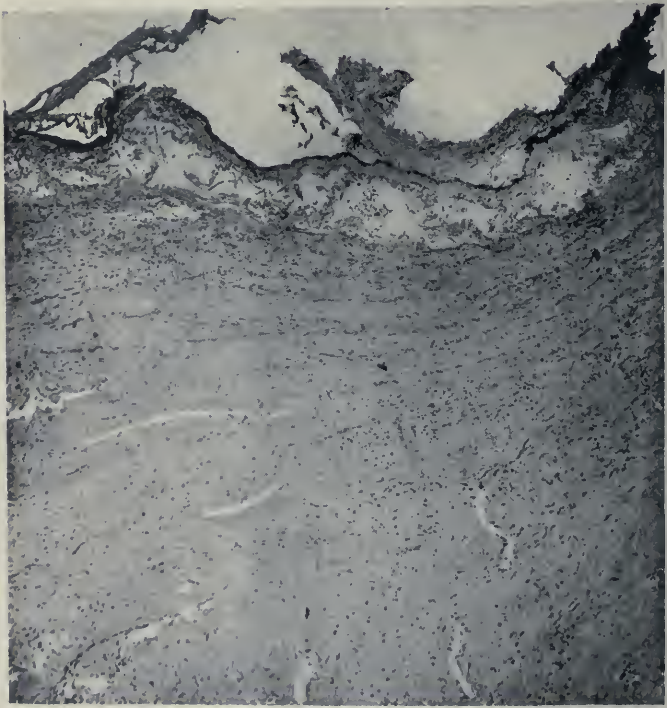

FIG. 4. Edge of the tumor showing pia, arachnoid, and dural sheaths.

choroidal vessels are distinctly evident, on account of the depigmentation in the choroid and retina.

A few of the choroidal vessels are clearly seen, and are of a white color, which is probably due to a lack of blood in the vessels, and not to any degenerative changes in the vessel walls.

Numerous small oval-shaped whitish exudates are scattered near the macular area; larger greenish colored exudates are seen over various areas of the fundus. A large white patch, sharply but irregularly outlined, with retinal vessels coursing over it, is seen on the nasal side of the disk. This latter area is probably due to a partial retinal atrophy. The retinal and choroidal atrophy is quite diffuse in some areas.

Scattered over the entire fundus, one sees heaps and patches of pigment, light and dark colored. This pigment is mainly present in the periphery, where it is darker. The fundus changes are progressing. No hemorrhages are present.

The numerous pathological changes in the fundus are primarily due to the cutting of the central artery and also some of the posterior ciliary vessels, thereby interfering with the internal and collateral circulation of the eyeball, which causes the inflammatory and the degenerative changes present in the retinal and choroidal tissue.

Pathological Report. Gross.—Specimen is a pale yellowish pinkish mass, the shape of an olive, weighing 4 grams and measuring 2.8 x 1.5*cm*, with a short thick stem about 6*mm* in length, which is optic nerve. The surface is smooth. The consistency is somewhat doughy. On section the tumor is seen to be covered by the dura which is fairly normal in appearance. The proximal end of the tumor appears to be a fairly normal optic nerve, rapidly widening into a loose arrangement, which is the tumor proper, showing a simple general longitudinal linear mixture of translucent gray streaks. One focal hemorrhage appears close under the meninges, and several smaller ones beneath the dura proper.

Microscopic.—No serial sections were made, but a few longitudinal sections were studied. Several photo-micrographs were made for illustration.

Dr. Ewing considers the tumor to be a ganglionic neuroglioma or glio-blastoma (Mallory), a tumor of epiblastic origin whose cells are differentiated into neuroglia cells with ganglion cells in addition.

The hæmatoxylin-eosin stain shows numerous ganglion cells scattered over parts of the section and also grouped together. Other fields are entirely free from these cells; in such places the bundles of optic nerve fibers do not appear disturbed. There is a definite increase of neuroglia tissue. In areas where the ganglion cells are found, the normal optic nerve structure is not evident. Ganglion cells lie in masses of fibers; it is impossible to state whether these are optic nerve fibers or fibers from the ganglion cells or neuroglia without special staining.

The ganglion cells vary in size and shape, some having a large pyramidal shape, others being smaller, and still others have an elongated and distorted outline. All are large enough to be designated giant cells.

The mesoblastic tissue or capsule surrounding the tumor is somewhat thickened showing no exudate. Walls of the blood vessels are not normal, showing the effects of pressure. There is a moderate amount of œdema in the tumor itself. There are numerous capillary hemorrhages which are rather recent. The structure of the tumor at the posterior extremity suggests the possibility of extension into the intracranial portion of the nerve. The ganglion cells and the hyperplasia of the neuroglia classifies the tumor.

Diagnosis.—Ganglionic neuro-glioma. I am indebted to Dr. Meeker for the pathological report.

From the clinical and pathological study of the case, the growth is probably benign and primary in the optic nerve. It is reported for the reason that it is, no doubt, the first case observed that shows definitely the presence of numerous ganglion cells occurring primarily in an intradural tumor of the optic nerve. As yet the nature of these cells cannot be definitely determined; they are probably of embryonal origin. It seems likely that these cells demonstrate another link in the embryological connection between the structure of the retina and the brain.

EXPERIMENTAL STUDIES IN INTRAOCULAR PRESSURE AND TONOMETRY.[1]

By WILLIAM McLEAN, M.D., New York.

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(*With three figures in the text.*)

LITTLE did I realize, when I began my work on intraocular pressure that my experiments would direct me into the paths laid out for me to follow. I had been using the Schiotz and Gradle tonometers and believed their readings to indicate the intraocular pressure.

In using these instruments I discovered certain annoyances which it seemed to me could be abolished in a tonometer constructed along different lines.

1. The distance between the cornea of the eye under examination and the reading scale of the Schiotz or Gradle instruments renders it difficult for one person to see that the tonometer is placed correctly on the cornea, and make a reading of the scale simultaneously.

2. A translation of the obtained readings into millimeters on the chart according to the weight used is necessary and consumes time.

3. The delineation of the fine lines on the chart is very trying to the eyes.

4. There are times when the estimated pressure is so far divergent from the indication by the instrument that a delay occurs to change weights, after the reading has been started. (Some nervous patients become annoyed while in the recum-

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[1] Paper read before Section on Ophthalmology, New York Academy of Medicine, April 15, 1918.

bent position by the delay caused in changing weights, when it has been ascertained that the estimated weight was inadequate for the pressure of the eye under examination.)

In this respect the Gradle instrument is an improvement on the Schiotz as with the Gradle the changing of weights is simplified.

5. I have observed in both these instruments that the plunger fits the footplate barrel so closely that fluid remaining on the cornea at the time of making a reading may be drawn up into the instrument by capillary attraction and the accuracy of the reading impaired.

(Paul Knapp of Switzerland observed this same possibility of error due to capillary attraction.)

In my tonometer the calibrations on the scale are in millimeters of Hg. as determined by actual manometer readings, using the testing apparatus described in this paper.

The scale is placed just above the finger piece and as close to the eye as possible so it can be more readily observed by the operator.

The plunger instead of fitting accurately has a space of one millimeter between it and the base, and is held in position by the rounded ends of three hardened steel bearings placed 120° from each other. This reduces friction to a minimum and also prevents capillary attraction of any fluid which might remain on the cornea.

All the readings on the scale from 10 to 130*mm* Hg. are made without change of weights.

Before the days of the Schiotz tonometer I had been estimating the intraocular pressure of patients by the prevailing method of finger palpation. Estimations of pressure if we translated them into *mm* of Hg. were based on the experiment of Wahlfors. His determination of normal intraocular pressure was 26*mm* Hg. which was in harmony with the experiments on the lower animals, made by many other experimentors. This is the only experiment on record in which an eye of normal tension has been connected directly to a manometer.

When the Schiotz tonometer was adopted a new conception of the normal intraocular pressure was introduced. The Gradle tonometer is a copy of the Schiotz and Dr. Gradle wrote me that he used a Schiotz tonometer to determine the scale for his tonometer.

My experiments tend to revert to the standards as established by Wahlfors and the early experimentors rather than the newer scale put forth by the Schiotz tonometer.

Before constructing my tonometer I reviewed all the literature on the subject I could find.

The first reference I found was that of Mackenzie who in 1830 observed that a hardness of the eyeball occurred in glaucoma. The importance of the correct conception of the intraocular pressure has been admitted since the full force of Mackenzie's discovery became manifest, and we find in looking over the history of Ophthalmology, that investigators early appreciated the inaccuracy of the estimation of intraocular pressure by the digital method.

The manometer in actual connection with the interior of the eye and with a perfect technique is the only method known today of obtaining absolutely accurate conceptions of the intraocular pressure.

The first records of experiments in ophthalmo-manometry that I could find are those of C. Weber in 1850 but he fails to draw any conclusions as to the normal intraocular tension. Later Wahlfors made some experiments with the human eye in situ in connection with the manometer and in some correspondence I had with Prof. Fuchs he advised me that Wahlfors's conclusions were in harmony with mine.

Two types of instruments have been devised. One called the impression type, that which records the amount of indentation or dimpling by a known pressure, and the applanation type, that which records the amount of flattening of the eyeball to a known pressure.

As early as 1863 von Graefe constructed a tonometer which was of the impression type. At the same time and independently of von Graefe, Hamer under the direction of Donders constructed an impression tonometer which was designated to be placed directly on the eyeball. Readings of the von Graefe and Hamer tonometers were obtained by pressing the instrument with the hand against the eye under measurement. Dor recognized the unreliability of any method which employed the hand to produce the pressure, and proposed that the tonometer should be suspended by a string and allowed to work on the eye by its own weight. Impression tonometers were also made by Donders, Monnik, Lazerat, Priestley Smith, Snellen, Hembold, and others. The Hembold instrument was constructed to determine the intraocular pressure of the two eyes of an individual at the same time.

The tonometers of Fick and Maklakoff are good examples of the applanation type. The Fick tonometer was constructed on the principle of a spring lever pressing against a flat plate of a definite area, applied over the sclera, and noting the tension necessary to produce a flattening of the sclera equal to the area of the plate. In this instrument the hand is the source of energy for the spring.

Ostwalt and Koster made some minor modifications of the Fick tonometer but retained the general principle of that instrument.

The Maklakoff tonometer differed from those already mentioned and was designed to be placed on the uncovered cornea, and rested on the eye by its own weight. The instrument consisted essentially of a weight which had on its contact surface a flat disk of polished glass 1*cm* in diameter. When the instrument is to be used a smear of coloring solution is applied to the free surface of the glass, and the instrument allowed to rest momentarily on the cornea. Contact with the cornea presses the coloring solution out, and thus a ring of solution is formed, the inside clear area of which is equal to the area of flattened cornea. A transfer is immediately made on prepared paper from which the intraocular pressure is computed.

Of the many tonometers brought out up to the time of the Schiotz instrument, the Maklakoff was perhaps the best suited for general use.

The usual method of determining the intraocular pressure experimentally has been to introduce a canula into the interior of the eye, and attach a manometer by means of tubing to the canula. Both the water and mercury manometers have been employed, depending on the construction of the apparatus.

Among the experimentors are: Weber, Leber, Neisnamoff, Pfluger, von Hippel, Grunhagen, von Schulten, Stocker, Starling, Adamuk, Holtzke, Hill, and Flack.

The experiments performed by these men were on dogs, rabbits, and cats, and their conclusions are that the normal intraocular tension of these animals varies from 18 to 35*mm* of mercury.

The experiments of Weber and Wahlfors were on the human eye.

In constructing an apparatus for my experimental work on eyes in situ, I tried to incorporate the good features of the apparatus used by previous investigators with improvements of my own design. I made a canula having a tapered steel needle, the opening in the needle being on the side. The taper conformed to an angle of two degrees and had two flat sides. I made two needles, the lumen of the one used in the anterior chamber was .8*mm* in diameter, while for use in the vitreous a needle of 2*mm* bore was used.

To overcome any possibility of altering the original tension of the eye by the volume of metal thrust into the eye, a needle valve was interposed in the lumen just far enough back from the opening to compensate for the volume of the metal in the eye. A half turn of the valve was sufficient to completely open the needle.

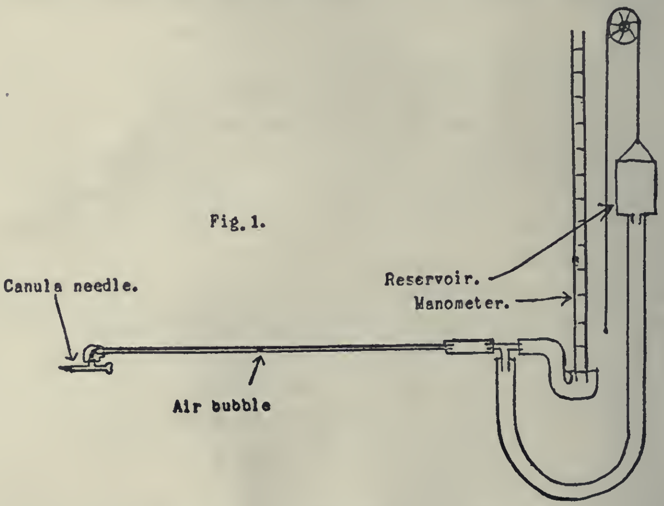
Investigators have repeatedly found that canulas of small bore will become clogged when used in connection with the vitreous chamber. I discovered while working on the living eye that my needle of .8*mm* bore could not be depended on when it was in connection with the vitreous chamber, but it worked very nicely in the aqueous chamber. With the 2*mm* needle I had no trouble.

One experimentor has published his results of work done along the line of intraocular pressure with the Schiotz tonometer where he used a canula of .8*mm* bore on eyes of the dead human being. During life the pulsations imparted to the fluid of the testing apparatus which comes in contact with the contents of the interior of the eye is an indication that the canula has not become clogged. With dead eyes there is no pulsation to aid the experimentor, so it is impossible to know that the apparatus is working properly. I made these experiments before the paper referred to above was published. After reading the article, to satisfy myself, as to the value of experiments with an .8*mm* needle in the vitreous, I repeated the experiments and found they verified my first conclusions.

In my work the canula was connected to a thirty-inch-long glass capillary tubing by short lengths of rubber pressure tubing. The total volume of fluid contained in the capillary tubing was about ten minims. The other end of the glass tubing was connected through a T piece to a manometer and a reservoir. The object of the capillary tubing was to enable me, by means of a small air bubble sucked half way up the tubing, to compare and equalize the manometer and the intraocular pressures.

A water manometer was used, but it was graduated to its equivalent in millimeters of mercury. The reservoir was suspended and was capable of adjustment as to height, in order to alter the manometer pressure at will. Fig. 1 shows a cut of the apparatus. Fig. 2 shows an enlargement of the canula needle.

Fig. 1.



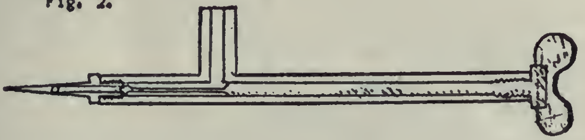
In using the apparatus the needle was introduced with its valve closed, and the connected manometer registering the estimated intraocular pressure. The position of the air bubble was marked and when all was in readiness, the valve was given a half turn and the movement of the air bubble noted. If the bubble moved toward the manometer it indicated a greater intraocular than manometer pressure, and vice versa. A manometer pressure was obtained which caused the bubble to remain at, or, in case of movement, to return to its original position. A reading of the manometer was then made.

Great care had to be exercised to prevent any traction or pressure of the needle on the eyeball.

To the present time, of living animals I have employed rabbits and dogs, with the exception of three living human eyes.

I have been particularly fortunate in being allowed to make experiments on three human eyes in situ. These eyes were all glaucomatous and were being removed on account of an uncontrollable pain. The experiments of two were performed before I had my tonometer perfected. On the third both the Schiotz and McLean tonometers were used.

Fig. 2.



In my experiments, an observation was made, one which I have never read or heard of: that the tonometer gave a marked difference in intraocular pressure under local, and immediately after under deep general anæsthesia. The animal was first cocainized and the intraocular tension determined by tonometer, then after administering the anæsthetic the tonometer was again used before any other instrumentation was done. On the human cases observed the same proportion of difference prevailed.

I have not made enough observations of this difference in intraocular tension before and during deep general anæsthesia to do more than merely mention it as occurring among all the tests made.

I spoke to the late Dr. Marple of this observation and he noted it when he was present at one of the experiments. Later, in a conversation he had with another oculist, on the subject of the difference of ocular tension in local and deep general anæsthesia, he made the statement that he had since observed that difference in his operative work.

At the time most of these experiments were made I had not finished perfecting my tonometer so the tonometer readings were made with Schiotz tonometers.

The tonometer readings on the human eyes were all made by Dr. Hallet. Dr. Marple was present when one of the tests on a rabbit's eyes was made and his Schiotz tonometer was used.

ANIMAL EXPERIMENTATION

First rabbit: The Schiotz tonometer registered 17.5 under cocaine and under ether 12. The small canula was introduced into the anterior chamber and a manometer reading of 33 was made. The anæsthesia was increased and the manometer pressure fell to 29.5, then 25, 23, 22, 22, 22. The anæsthesia was continued and made more profound from the time the canula was inserted until a continuance of the anæsthetic failed to further reduce the tension. The anæsthetic was then removed and the manometer pressure required to keep the air bubble at its mark had to be gradually increased and rose to 30*mm* when the animal showed signs of regaining consciousness, and the needle was removed.

The air bubble all the time showed pulsations which were synchronous with the animal's heart beat. Such pulsations are a positive evidence that there is free communication between the interior of the eye and the manometer.

Second rabbit: This animal was quite refractory before general anæsthesia was used so that we could not get a satisfactory reading under the local anæsthetic. When general anæsthesia was applied he succumbed rapidly and by the time we were ready he was quite deeply under the anæsthetic. The Schiotz tonometer then recorded 12*mm* Hg.

The canula was immediately inserted and the pressure per manometer was 19.5, then it dropped to 17, 16.5, 16.5, 16.5. No further drop in the tension occurred and the anæsthetic was removed. Shortly the tension began to rise and manometer readings were recorded at 21.5, 23.5, and later 25. When the manometer had reached 25*mm* the needle was removed on account of signs of returning consciousness of the animal.

Third rabbit: The Schiotz tonometer under cocaine and before ether anæsthesia registered 23. During ether 16.5.

The needle was inserted into the anterior chamber and a reading of 27*mm* was made. Then it dropped to 21, 19.5, 19.5, 19.5. The anæsthetic was removed and the tension rose as in the others, until it reached 26*mm* of manometer pressure.

Fourth rabbit: The Schiotz instrument under cocaine registered 21*mm* Hg. and as soon as the animal was judged sufficiently etherized a reading of 14 Schiotz was recorded. The manometer at that moment registered a pressure of 24*mm* and as the anæsthesia was deepened the intraocular pressure dropped, the lowest reading being 20.5*mm*. There seemed to be no further drop in pressure so the anæsthetic was removed and readings were recorded at 22, 27, 28, when the animal showed signs of recovery.

Probably this rabbit was deeper under the anæsthetic than we appreciated when we started our manometer readings, as the drop from the first to the low reading was less than the others except the second rabbit, which we knew was well under the anæsthetic when we started, and because on the recovery the intraocular pressure rose to 28*mm* by the manometer.

Fifth rabbit: The readings were O. D. 17 and O. S. 16 Schiotz, under cocaine, and when etherized readings of 8*mm* Schiotz were made on each eye. The canula of .8*mm* bore was introduced into the vitreous chamber of one eye. Soon after the needle was inserted the pulsations of the air bubble ceased, and the changes of manometer pressure were not attended with the usual quick response of the air bubble. The needle was removed and was found to be clogged with vitreous.

After cleaning the needle it was inserted into the anterior chamber of the other eye. The animal was then under deep anæsthesia and the manometer registered 15*mm* Hg. At this point the animal's breathing almost stopped and the anæsthetic was removed. Artificial respiration had to be resorted to and the animal partially revived, and a manometer reading was recorded at 16.5*mm*. The animal choked with mucus before other readings were made and all efforts to restore him failed.

Of the human eyes in situ used, the first case was one of total blindness in that eye from absolute glaucoma, and the eye was being removed on account of uncontrollable pain. Tonometer readings were made on both eyes under holocain anæsthesia. The tension of the affected eye was 75 while the healthy eye registered 19 Schiotz.

Under ether the affected eye registered 45 and healthy eye 10 Schiotz.

A canula as described before with a bore of 2*mm* was thrust into the vitreous chamber well back of the ciliary processes. After the position of the air bubble was marked, the valve was opened. It was found that a manometer pressure of about 65*mm* held the bubble at its mark. With the needle in the vitreous chamber we were able to make tonometer readings and compare them with the manometer, which readings were as follows:

Schiotz's tonometer	Manometer pressure
50	65
50	65
43	64
50	66

Tests made on this same eye after it had been enucleated gave the same ratio of variance between the manometer and Schiotz tonometer in all pressures of 10*mm* to 120*mm* Hg. as may be noted by Chart I.

On the second human eye tested, readings were made of the affected eye only. Before general anæsthesia a Schiotz tonometer reading of 88*mm* was made, and at the first reading under general anæsthesia the Schiotz recorded 72*mm* Hg.

The canula was immediately inserted and the Schiotz again recorded 72 which shows that the insertion of the needle made no change in pressure. The valve was opened connecting the interior of the eye with the manometer and a manometer pressure of 88*mm* was required to keep the air bubble in its original position.

As the anæsthesia was increased tonometer and manometer readings were made, which were:

Manometer	86	Tonometer	72
"	81	"	54
"	72	"	47

As the anæsthetic was continued there was no decrease of intraocular pressure below 72 (manometer) so the experiment was concluded and the eye enucleated.

CHART I

Human eye in situ used at the hospital for tests with water manometer and Schiotz tonometer. (Diag. Glaucoma Absolutum, O. D.) Manometer needle, 2*mm* bore, with valve, and glass capillary tubing 30″ long and 1*mm* bore. Needle was connected with vitreous chamber.

	O. D. Schiotz	Manometer	O. S. Schiotz
Before anæsthesia	75		19
During "	45		10
" "	50	65	
" "	50	65	
" "	43	64	
" "	50	66	

Same human eye (enucleated):

Manometer *mm*Hg.,	15 *Gm.*	10 *Gm.*	7.5 *Gm.*	5.5 *Gm.*
120	105			
110	96	86		
100	86	71		
90	58	65		
80	53	60		
70	42	56	62	
60	33	51	43	43
50	23	32	31	35
40	14	23	20	22.5
30	6	14.5	19	16
20	X	6	11.5	7.5

On the third human case both the Schiotz and McLean tonometers were used. On account of the conditions present we were allowed time only to make one reading each. In my haste I perhaps chose a faulty location for my canula as it was with difficulty that we could keep a connection of the interior of the eye open to the manometer as evidenced by the diminished oscillations of the air bubble, when as in the other cases the bubble oscillations were readily discerned all the time the valve was open.

The readings of this last case were, Schiotz 40, McLean 58, and the manometer recorded 60*mm.*[1]

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[1] The demonstrations of the three human cases above cited were all made at the New York Ophthalmic Hospital in the presence of eye specialists. At the demonstration of the third case about thirty oculists were present.

It may be noted in all the experiments on the living eye, both human and animal, that the intraocular pressure was highest under local anæsthesia, and as soon as the patient was thoroughly under the influence of the ether the pressure was lowered; the deeper the anæsthesia the lower the pressure until a limit was reached.

In the animals we noted that the pressure rose, after the ether cone was removed, until it was back to its original pressure as the animal regained consciousness.

My aim in the work as shown in Chart II (experiments on dogs' eyes) was to find the relation of readings of the eyes in situ and immediately after enucleation. In this work the needle with the *2mm* bore seen in Fig. 2 was inserted into the vitreous chamber. The Schiotz readings before and after enucleation, and the corresponding manometer pressures are given side by side. It may be noted that the readings of the eye in situ agree very closely with those made after enucleation when connected with the apparatus I use for testing with enucleated eyes.

CHART II

Dogs' eyes. Tests made with Schiotz tonometer. Tests on eyes in situ, cocaine, then ether and tests on same eyes after enucleation.

	RIGHT EYE		LEFT EYE	
Manometer	In situ	Enucleated	In situ	Enucleated
	Schiotz tonometer		*Schiotz tonometer*	
96	77	81	80	
90	72	65	75	65
80	57	59	59	57
70	54	55	51	49
60	47	46	44	46
50	37	32	40	37
40	26	28	24	26
30	17.5	17	22.5	17
20	12	8	16	8
Cocaine	25		25	
Ether	13		22.5	

Chart I shows the readings made on the human eye in situ, and the corresponding readings after the eye was enucleated. It has been suggested that inasmuch as the large number of tests I made on living eyes in situ agreed with the tests of those same eyes after enucleation it is pretty good evidence that my testing apparatus for enucleated eyes is fairly correct.

In my early experiments I tried the rubber dam apparatus suggested by Schiotz to be used in place of enucleated eyes, and found it entirely inadequate. I have learned since that Schiotz discarded this type of testing apparatus, and made the statement that he was sorry he ever brought it forth. To the present time I have found no satisfactory substitute for enucleated eyes in making the tests.

My testing apparatus for enucleated eyes consists of a water manometer, with its necessary connections of glass and rubber tubing; a canula connected to a stop-cock by short length metal tubing, to which is attached the apparatus which I have termed a pulsator.

I have used both the mercury and water manometers, and found the water manometer more convenient for use. The results were the same as of course they should be.

The canula I made with a *2mm* bore and made a trocar to fit, so that it could be inserted through a sufficiently long optic nerve into the vitreous chamber.

The connection between the eye and the stopcock is made entirely of metal to avoid the possibility of expansion by a more elastic substance.

The pulsator is an apparatus which I have constructed to simulate the pulsations of the arteries of the living eye. You have all noted in using the tonometer that there are oscillations of the needle which are synchronous with the heart beat. My apparatus causes these same slight oscillations of the indicating needle. The apparatus is run by clockwork.

THE TESTING OF MCLEAN TONOMETERS.

For testing tonometers, the enucleated eyes must not be kept in any hardening or preserving fluid and should be used as quickly as possible after enucleation. A few hours is sufficient to alter the resiliency of the tunics of the eyeball for testing purposes. They must be absolutely fresh.

While the eye is being used in the testing apparatus it is ensheathed in a rubber cap which acts similar to Tenon's capsule. This cap is of extremely thin high-grade rubber tissue and is sufficiently large so as not to be put at all on the stretch when the eye is placed in it. It encases the eye almost to the margins of the cornea, and acts as a reservoir to hold the normal salt solution which keeps the eyeball from becoming less resilient.

Before using the eye it is cleared of all extraneous material down to the sclera. The imitation Tenon's capsule is adjusted and the canula with its trocar is passed in through the center of the optic nerve until the opening is in the vitreous chamber, when the trocar is withdrawn. A perfectly tight joint must be obtained, and the canula adjusted to the short metal tubing connected to the stopcock.

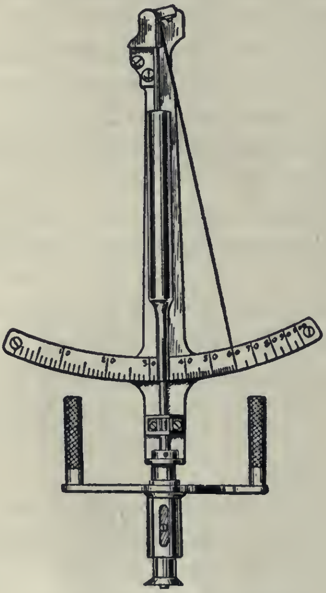

Fig. 3. McLean Tonometer.

Outside the rubber tunic an adjustable ring support around the optic nerve acts as a base to support the eye without inducing any pressure or traction.

As soon as the eye is placed in position, I fill the rubber tunic with a normal salt solution. This keeps the eyeball from becoming less pliable, as the eye under pressure changes quite rapidly by contact with the air.

When all is in readiness the petcock is opened. The pressure of the liquid should be raised in the manometer until the correct height is reached. (Do not proceed from a greater to a lesser pressure.) After the desired pressure is obtained an interval should elapse to allow the tunics of the eye to become adjusted to that pressure before a reading is made.

I have a solution of normal salt at hand, also a pipette with which I am constantly dropping the normal salt on the cornea before each application of the tonometer. The stopcock remains open, except when it is closed to make a tonometer reading. It is opened immediately after the reading and remains open until the next reading.

With this apparatus I am able to obtain any pressure from 0 to 135*mm* of mercury.

It was by actual tests with this manometer, using several tonometers on repeated readings, that the present scale on the McLean tonometer was adopted.

With this tonometer the lower limit of normal intraocular pressure is to be considered as 22, while I have not found a normal eye registering above 40. I have placed the upper limit at that figure because I have found eyes registering 40 in which there were no symptoms, subjectively or objectively, of glaucoma. It is difficult to give an absolute limit of normal tension. I have found a few eyes that registered 36 with the McLean tonometer and 22 with Schiotz in which symptoms of glaucoma were present.

Altogether in my experimental work I have tested nearly two hundred enucleated eyes, and a considerable number of eyes in situ of the lower animals.

Aside from the work of Weber and Wahlfors I think I am the only man who has done any experimental work on living human eyes, by connecting the interior of the eye to a manometer.

TWO RARELY DESCRIBED INSTANCES OF SCINTILLATING SCOTOMATA; SELF-OBSERVED.

By Dr. JAMES A. SPALDING, Portland, Maine.

DR. C. H. MAY in his *Text Book on Diseases of the Eyes*, eighth edition, page 292, and Casey Wood in his *Ophthalmic Therapeutics* at various places, speak of scintillating scotomata associated with symptoms of migraine, and probably due to circulatory disturbances in the occipital lobe. The scotoma, as they describe it, begins before each eye with a dark spot and spreads in scintillating and zigzag outlines (fortifications, embattlements) until there is a gap in the visual field, and occasionally the patient becomes temporarily blind. The phenomenon is always accompanied with headache or other symptoms of migraine, is probably due to eyestrain or physical exertion, occurs frequently, for a while, generally disappears in time, and is amenable to treatment, such as proper lenses, and rest of the eyes and body.

Although in practice for nearly fifty years, now, I have never seen a single instance of this sort in a patient, and for that reason it has occurred to me, that for the possible benefit of other oculists[1] it might be worth while to offer to the readers of the ARCHIVES a brief account of personal experience with two varieties of scintillating scotomata. And all the more so, since those which I have perceived have never been associated with headache, or migraine, or any physical symptoms.

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[1] It is to be hoped that the present taboo against the word "oculist" will ultimately cease, for it is burdensome to be compelled to resort to the euphemism of "ophthalmologist," "ophthalmic surgeon," or "ophthalmological practitioner" as has to be done by writers in order to steer shy of "oculist." Surely, there is no harm in plain "eye doctor" whilst the Latin word "oculist" is no more distasteful to the eye, or the ear, than words derived from the Greek.

When very young I was hit in the left eye with a piece of steel, so that the sight was damaged, and the right eye used almost exclusively for far and near ever since. Some years ago on awaking in the morning after considerable use of my eyes by electric light the night before with + 2 D. S., for presbyopia, the sight of the right eye was so much blurred that I could not tell the time by a clock which I kept near at hand, so as to know how much time I had to spare to get my breakfast and catch the morning boat from an island where I was summering. I had the eye tested and examined at once by two competent observers, who found that, without warning I had developed in this eye an astigmatism of + .25 cyl., axis 105°. This lens was prescribed and worn steadily. The media were declared to be normal and transparent. In a few weeks the astigmatism increased to + .75 and the axis swung up to 90°. Later on, the axis went over to 65° where it remained some months. Then the astigmatism decreased to + .25 D. C., and the axis after a few variations settled back to where it originally was marked, 105° where it has now remained some years without change. Meanwhile, hyperopia of + 1 D. has developed, and at present with + 1 D. S. and + .25 cyl., axis 105°, vision in O. D. is normal. During the winter months, however, when the skies are misty, and the sun runs low, the hyperopia increases to + 1.50 or even to + 1.75, the astigmatism remaining as of old. Presbyopia is + 3. As a result of these curious changes in the focus of this eye I was obliged for some years to keep on hand three sets of lenses, for any possible changes in refraction during a long game of billiards, or auction or prolonged use of the eyes. The left eye remains unchanged with vision about $\frac{1}{6}$ with + .75 D. S.

I have never tried to puzzle my consulting friends concerning these curious changes in refraction, but have fancied that as my health was perfect and media transparent, as repeatedly assured, these might be due to alterations in the position or relation of the crystalline lens to the retina from some irregular spasm of the ciliary muscle. The pupil, by the way, has always been circular, so far as I have been informed, or observed personally.

These details have been mentioned, as they may have some connection with the scotomata about to be described, as well as to offer suggestions for the management of patients who from the same reasons, or with the same symptoms as mine, feel dissatisfied with lenses carefully prescribed, and properly made but a short time before. In my own experience with patients, I must say that I do not recall such odd changes in astigmatic axes, as have been mentioned, but which, if observed by others, might account for those curious instances in which we find new patients complaining that they have consulted other oculists without obtaining satisfactory lenses. With such a pair of eyes, then, in which one is used and has been used unsparingly for years at innumerable literary tasks, let me now mention two varieties of scintillating scotomata observed during some years past.

Soon after beginning to wear the lenses first mentioned for constant use, I was at a wedding by the seashore, sitting on a piazza and looking out on the sparkling ocean shining brilliantly beneath a summer afternoon sun. Suddenly there appeared before me at the center of vision a black oval spot about the size of a bean. It changed gradually to a greenish center, and the margins began to be crenelated, and zigzagged, increasing by leaps and bounds until the entire field of vision was absorbed with a great glare of light. The center remained a pale Nile green, the fortification margins a brilliant sparkling blaze of sunlight. I was not blind, for I could see everybody about me, but I could not see to read, because I tried it at once using a book near at hand. This lasted about two minutes, and then the center of the scotoma began to clear and the outside waves of light to expand ever wider and wider apart and into the extremes of the visual field when they disappeared. In three minutes, as it seemed to me, I could see as well as ever. I had no other symptoms. This scotoma I have seen at intervals for years; it is generally oval with axis horizontal; it comes without warning but generally in warm weather and it never varies in size, color, or behavior. I never see it in the open country, but generally after looking at bright light from confined interiors of houses or in looking up, after using the eyes steadily in the daytime. I have never seen it by artificial light.

The second scotoma originates in an entirely different manner and differs, also, essentially from the former in various ways. It always follows physical labor in my garden such as weeding, raking the grass after cutting by the lawn mower, or hoeing down the path for weeds, the boy following with a rake. Most of this work is done, not by bending over, but by kneeling on a newspaper like a woman. No matter how hot it may be, nor how hard I work, there is no symptom from the sight until I finish and then go down the bulkhead stairs into the dimly lit cellar in order to avoid passing through the kitchen. Thereupon, the scotoma appears in an instant. It is, however, no longer oval as in the case of the other but kidney shaped, with a section cut out at the right, where as might be said the ureters fit in. At first very minute and black it expands rapidly, the center taking on a distinct rose color, with outside waves as before of glorious sunlight. Proceeding wave by wave on the outside of the kidney-shaped center, it progresses to the outermost parts of the field of vision and finally disappears, as it began, from the center. Whilst this is going on, it seems as if the circulation in the retina must be interrupted and that each outside wave of the scotoma represents an effort of arterial blood to push down into the retinal vessels, and to force, as it were, a path for blood and consequently for light and sight. Like the first scotoma, this second one has only a transitory effect on the vision, and the eyes can soon be used as before. Having observed, at last, that the second obscuration is due to contrasts of light, it is hardly necessary to add that in order to avoid its anxieties and discomforts I now avoid the contrast between the bright light of out of doors and the dim light of the cellar, and make my way indoors through the well-lit kitchen.

The kidney-shaped scotoma always lies more obliquely than the oval affair, and the depression is always to the right. The depression sometimes suggests the place seen in an apple for insertion of the stem. I cannot help emphasizing the difference between the Nile-green color of the center of the oval scotoma in comparison with the rose-colored center of the kidney shaped.

It seems to me that patients observing such appearances as these which I have here described would be extremely agitated.

and for the very reason that mine are invariably followed by perfect sight again, I have mentioned them in detail, so that other oculists if consulted for such could honestly quote such a paper as this, from a competent observer, and assure their patients that the symptoms would terminate favorably, although they might recur from time to time after too much bright daylight or overwork out of doors, and coming into shaded or darkened rooms.

Much as we all dislike to parade our personal symptoms, I have felt it for the best to offer brief notice of my own oddities in eye practice because they illustrate sudden astigmatism and curious changes of axis; hyperopia with alternations according to bright or clouded skies; two different scotomata: one with fortification margins and greenish center, the other oval with rose colored center, lasting a few minutes and leaving the vision totally unimpaired.

ILLUSTRATING DR. DUNN'S ARTICLE "A NOTE ON THE SURGERY OF THE MEIBOMIAN CYSTS."

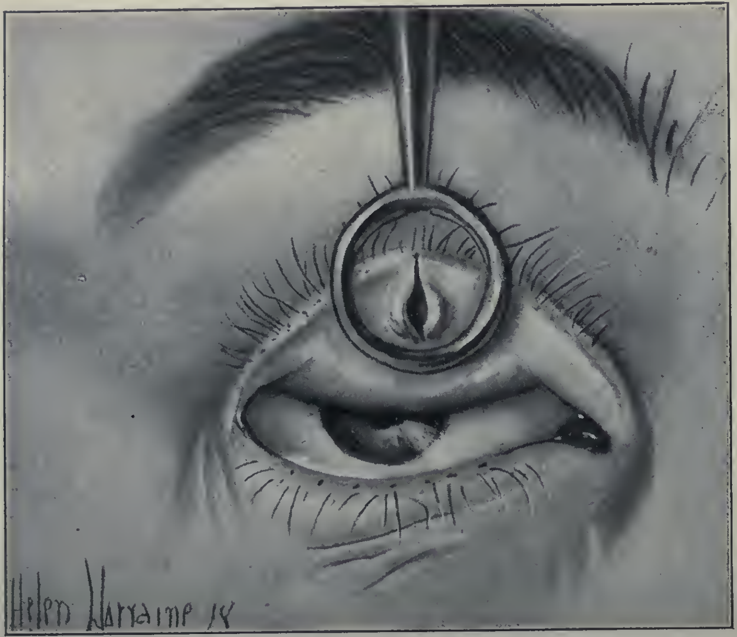

FIG. 1.—Completed operation, done after manner described.

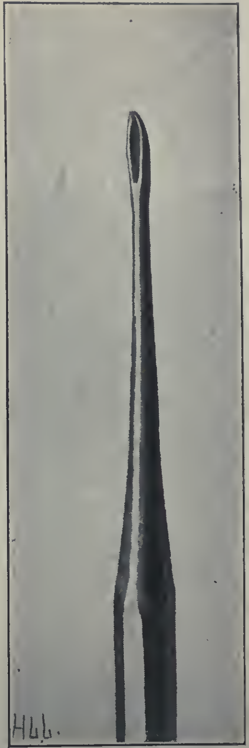

FIG. 2.—Curette found to be most suitable.

A NOTE ON THE SURGERY OF THE MEIBOMIAN CYSTS.

BY DR. JOHN DUNN, RICHMOND, VIRGINIA.

(*With two illustrations on Text-Plate III.*)

WEEKS, *Diseases of the Eyes*, p. 171, says: "The cyst should be opened, the incision being made on the conjunctival surface in the long axis of the Meibomian gland. The contents of the cyst should be curetted out. An antiseptic ointment may be introduced into the eye two or three times daily. . . . A cure may be effected in the course of a few weeks or months." So far as I know, the above is a good description of the generally practiced operation for the removal of a Meibomian cyst. The line of incision is well illustrated in de Schweinitz's *Diseases of the Eye*.

For many years this was the method I pursued, but always with the feeling that other oculists must be getting more satisfactory results than I did. Following this method there was always suffered by the patient what seemed to me an undue amount of discomfort; the curetted sac took always a longer time to heal than I thought ought to be the case in a part of the body so well supplied with blood vessels as are the lids; and, lastly, I felt no assurance that further treatment would not later be required. I knew these things were so, but I could not understand why the surgery of so common an affection, and one apparently so simple, had not been long ago perfected. The explanation came to me quite accidentally and with it what I now believe to be a solution of all the difficulties. My willingness to present this short paper came from having lately had a patient with an uncured Meibomian cyst which had been operated upon seven times. It was cured at once by having recourse to the procedure to be mentioned.

The cyst, whether infected or not, should be split in the long axis of the gland, and the incision should always be carried *along the gland to and through its opening on the free border of the lid.* This is the important thing in the whole operation. Unless the affected gland be opened wide its whole length the operation will have been imperfectly done, for the proximal end of the gland, although apparently healthy, if not opened and curetted remains a possible source of infection and brings about all the troubles we have mentioned as occurring during the healing. This infection may already be present or may be acquired from the conjunctival sac during the course of healing.

My own method of doing the operation is as follows: Four drops of a one per cent. solution of novocain are injected beneath the skin of the lid overlying the Meibomian cyst. Three drops of a ten per cent. solution of cocaine are dropped against the conjunctival surface over the cyst; this is done twice at an interval of three minutes. At the end of ten minutes from the time that the novocain was injected an appropriate lid clamp is applied. A cataract knife is now inserted into the distal end of the cystic swelling, carried through and forced out of the opening of the gland on the free margin of the lid. The walls of the cyst, including the full length of the gland, are now curetted until they are smooth, after which they are wiped off with a solution of silver nitrate, fifteen grains to the ounce. The clamp is now removed and the patient is instructed to hold a piece of absorbent cotton firmly against the eye until the bleeding stops, after which a small amount of boric acid salve, five grains to two drams of white vaseline, is inserted into the conjunctival sac. The patient is told to put some of this salve into the eye three or four times a day. The results are all that can be desired.

ASTIGMATISM AGAINST THE RULE—ITS RECOGNITION AND FREQUENCY.[1]

By Dr. JOHN GREEN, Jr., and Dr. WILLIAM F. HARDY, St. Louis.

IT is universally recognized that the majority of astigmatic eyes have the meridian of greatest curvature at 90 degrees or within 45 degrees to the right or left of 90. Astigmatism with the meridian of greatest curvature in any position on the arc between these limits is called "astigmatism with the rule."

Conversely, astigmatism in which the meridian of greatest curvature is at 180 degrees or within 45 degrees, up or down, from 180 is designated inverse astigmatism or "astigmatism against the rule." Some writers limit the terms "astigmatism with the rule" and "astigmatism against the rule" to astigmatism in which the meridian of greatest curvature is, in the former case, at 90 degrees or within a few degrees of 90, and, in the latter, at 180 degrees or within a few degrees of 180. When the meridian of greatest curvature deviates decidedly from the vertical or horizontal, the astigmatism is called "oblique."

It is not always possible to determine just what are the boundary lines separating the three groups; and we suspect that different writers have used these designations in different senses. This is unfortunate, as it prevents a just comparison of statistics emanating from different sources.

DEFINITION OF ASTIGMATISM "WITH THE RULE" AND "AGAINST THE RULE."

In this study we have regarded all cases of astigmatism with the meridian of greatest curvature at any point on the arc from 46 to 134 degrees as astigmatism with the rule. All cases with the greatest curvature at any point from 0 to 44 degrees and from 136 to 180 degrees have been classified as examples of astigmatism against the rule.

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[1] Read before the Section on Ophthalmology, American Medical Association at Chicago, June 13, 1918.

Astigmatism with greatest curvature exactly at 45 or 135 degrees has frequently been classified as astigmatism with the rule. This classification seems to us purely arbitrary, as these cases might with equal reason be classified with astigmatism against the rule. Hence, we have omitted from consideration and classification the few cases of astigmatism we have encountered in which the principal meridians were at 45 and 135 degrees.

Our interest in the subject of astigmatism against the rule was stimulated in July, 1916, shortly after we began the systematic use of the astigmatic charts devised by Dr. Walter B. Lancaster.[1] Prior to this time, we had depended for the recognition and measurement of astigmatism on skiascopy, the test letters, the keratometer (Chambers-Inskeep), and various astigmatic charts. Of the latter we regarded as most satisfactory the wedge-shaped radii narrowing to the center, with the companion double-wedge crossing at right angles—Noyes's selection of Green's charts—and Verhoeff's astigmatic charts, which have concentric circles of fine lines and wider radii at 15-degree intervals, with the companion chart of wide lines at right angles crossed by finer lines. We have always made it a practice to search for the presence of astigmatism of the slightest amount at whatever axis, and have, of course, detected and corrected many examples of astigmatism against the rule. But it was not until we began the use of Dr. Lancaster's charts that we became impressed with the inadequacy of our former methods to detect and measure low grades of astigmatism. And it was not long before one interesting fact emerged, namely, that the number of cases of astigmatism against the rule in comparison with the total number of cases of astigmatism was greater than we had hitherto believed. We reached this conclusion independently.

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[1] Lancaster, W. B.: *Tr. Am. Acad. Ophth. and Oto-Laryngol.*, 1915, p. 167.

LANCASTER'S CHARTS.

Lancaster's charts may be described as follows: Chart 1 is a square 65 by 65*cm* of white, smooth, unglazed paper, or so-called wedding stock, on which a circle 30*cm* in radius is drawn. At intervals of 10 degrees, radii are drawn from the periphery to within 10*cm* of the center. Strips of black velvet baby ribbon, known in the shops as No. 1½, 7*mm* wide, 20*cm* long, are glued to the cardboard, extending from the periphery to within 10*cm* of the center. The finished chart may then be compared to a rimless wheel with thirty-six spokes, having a clear circular center or hub 20*cm* in diameter. Chart 2 consists of a square made from the same stock, measuring 45*cm* on each side. A circle 36*cm* in diameter is drawn on this square and the periphery lightly marked at intervals of 10 degrees. A disk 36*cm* in diameter is cut out of the same stock and two diameters of black velvet baby ribbon are glued to the disk at right angles. The disk is then pivoted to the marked circle by means of a double-pronged staple, such as is used for binding legal papers. The disk may thus be turned to any desired position.

It will be seen that in many respects Chart 1 resembles the familiar sun-ray figure. But there are some points of difference which, in our opinion, are of extreme importance, rendering the charts the most valuable of any we have used for the detection of low grades of astigmatism.

In the first place, the charts are larger than those generally in use. The radii are longer, thus enabling the patient to select the most distinct line with greater ease. Second, the numbers corresponding to degrees of arc are drawn very lightly at the periphery and only for the purpose of aiding the examiner. In some other types of chart these numbers, which are not concerned in the test proper, are drawn so conspicuously as to distract the patient's attention from the radiating lines. In the third place, there is the exceedingly sharp contrast between the pure smooth white surface of the wedding stock and the soft yet intense black (literally, "velvet black") of the baby ribbon. One has only to compare this chart with the ordinary engraved or printed astigmatic chart to appreciate how superior it is in respect to contrast. It is surprising, too, to observe that even after prolonged use, this chart does not become appreciably soiled—the smooth surface sheds dust very readily and the baby ribbon does not lose its velvety blackness. We have seen astigmatic charts in which the grime of the city had obscured all effective contrast and in which the black of the lines had faded to a rusty black or gray. In the measurement of higher degrees of astigmatism, it has been found of some advantage to have similar charts, but with No. 1 baby ribbon 5.5*mm* wide.

USE OF THE CHARTS.

We deem it of the utmost importance to secure a very accurate measurement of the dynamic refraction. We would not disparage for a moment the importance, nay, the vital necessity, of examining the refraction under complete cycloplegia in nearly all prepresbyopic patients, and, indeed, in many of those over the presbyopic age. Only in this way can information of importance to the patient and the oculist be secured, both as a present help in determining the immediate correction and as a guide to the subsequent management of the case. We are inclined to believe that many who employ cycloplegics habitually depend almost wholly on a knowledge of the static refraction and ignore the information, often very valuable, which is revealed by an exact estimate of the dynamic refraction. The reasons for this are twofold: First, the measurement of the dynamic refraction, even under the most favorable conditions, is a tedious process, requiring patience and care on the part of the examiner and the patient; the urge of a waiting-room full of impatient patients is not conducive to exactness in testing the refraction without a cycloplegic; second, the means at our command—keratometer, test letters, and the usual run of astigmatic charts, have not always revealed the existence of a low astigmatism.

The vast majority of astigmatic eyes exhibit this error in low degrees, and it is precisely in the detection and measurement of low degrees of astigmatism that Lancaster's charts possess their greatest usefulness.

We should like to dwell for a moment on the importance of preparing the patient physically and psychically for the test that he is about to undergo. It is vastly better to deal with a patient in the early morning, preferably before he or she has encountered any of the stresses of the day. It is equally important that the mind should be calm, and the attention not distracted. During the test we debar other patients from the refraction room. If the visual acuity indicates that the error is H + Ah or Ah, plus spherical lenses strong enough to blur the letters to $\frac{6}{32}$ or $\frac{6}{25}$ are placed in a trial frame before the eyes. The screen bearing the test letters, which are illuminated by frosted mazda lamps, is at the end of a darkened corridor. As soon as the appropriate spheres are placed before the eyes, the lights are turned off and the patient told to look vacantly (that is, not to rivet the attention on any object) into the "dark distance." The examiner busies himself with other matters, while the patient continues to stare vacantly into the dark. There is no incentive for the accommodation to assert itself in the interest of clear vision, and we are convinced that more complete relaxation is thus secured.

After a few minutes the lights are turned on and the patient is asked to read, with both eyes open. It is not unusual to find that vision has risen to $\frac{6}{20}$ or $\frac{6}{18}$. The left eye is then covered with a blind and the vision of the right determined. The patient's attention is next directed to the wheel chart, and he is given plenty of time to observe whether any differences are observable in the appearance of the spokes. Certain spokes may be declared to be "heavier," a term that seems to mean one thing to one patient and another thing to another. For one, the meaning is "broader but less distinct"; for another the meaning is "black and clean cut." If the fogging is too great and the astigmatism low, the radii may all look equally blurred, so that it becomes necessary to reduce the sphere. This should be done by intervals of 0.12 D., and with each reduction the visual acuity should be taken and attention redirected to the wheel chart. In the presence of any astigmatism one line or, at most, an adjoining group of three or four lines will emerge clear and sharp. It is absolutely essential that the change in the strength of the sphere should be so gradual as not to throw any part of the focal interval of Sturm behind the retina. We emphasize this well-known fact, because, as has been pointed out by Lancaster, one of the reasons for the failure to detect astigmatism with astigmatic charts is that the interfocal circle, which does not blur one line more than another, is, by reason of insufficient fogging, permitted to fall on the retina. Under these circumstances the lines, though blurred, appear uniform, and the examiner is apt to fall into the error of assuming that no astigmatism exists.

When one, two, or three adjoining lines appear more distinctly demarcated against the white background, we can feel assured that some astigmatism exists. If two adjoining lines are equally distinct it is almost certain that the correct axis lies between them. Thus, with the lines placed at intervals of 10 degrees, the chart will frequently give us the precise axis, that is, within 5 degrees, which, for most eyes, is within the limit of possible accuracy. The cross on the disk is then placed with one arm corresponding to the selected line, and gradual reductions with minus cylinders, at right angles to the selected line, are made until the other arm is rendered equally distinct. It may then become necessary slightly to reduce the spherical element in the interest of the sharpest acuity. In case of this reduction a retest with minus cylinders is made and the weakest minus cylinder which equalizes the arms of the cross is the measure of the astigmatism.

It must be admitted that this method is time consuming. The patient's attention is apt to flag, and it is wise to allow him some intervals of rest. But these are minor drawbacks; we feel well repaid for our time if we succeed in unearthing a low astigmatism which has eluded other methods of examination, including skiascopy.

Experience indicates that a fairly large number of cases of low astigmatism give no evidence of their presence to the shadow test. In low grades of astigmatism, it is often exceedingly difficult to be certain of the measurement to 0.12 of a diopter. We have therefore eliminated all cases which showed no more than 0.12 D. of astigmatism, at whatever axis.

In the determination of the exact axis, we have been largely guided by the patient's selection of the line on the astigmatic chart, but have often permitted him to rotate the cylinder to that position which rendered the smaller letters the sharpest.

While this expedient is of great value in astigmatism of 0.75 D. and upward, it is very difficult, in lower degrees, for the patient to be sure within 15 degrees of the precise position of the axis.

Our experience leads us to believe that inverse astigmatism is extraordinarily frequent in cases of chronic glaucoma. Such cases, as well as any examples of deformation of the cornea from injury or disease, pressure (chalazion), traction (pterygium), or operative corneal section have been rigidly excluded. Every patient included in our series has been examined ophthalmoscopically and the eyegrounds have been found normal.

In these cases we have not considered the question of muscle balance for the reason that, although the balance and ductions were determined in nearly every case, we were able to convince ourselves that the presence of low degrees of inverse astigmatism was without influence on the function of the extrinsic muscles. We believe many, if not the majority of the cases of low inverse astigmatism are lenticular in origin. This view is supported by the fact that in no less than seventy-one eyes with astigmatism against the rule the ophthalmometric measurement showed a total absence of corneal astigmatism.

There is a greater interference with visual acuity in the case of inverse astigmatism than in the case of an astigmatism of equal amount with the rule. One has only to render oneself artificially astigmatic with the rule and then artificially astigmatic against the rule (using the same cylinder) to appreciate the difference in distinctness of the same line of letters.

It by no means follows that every eye presenting inverse astigmatism should have this anomaly corrected. Elderly patients, who have worn spheres for many years and are well satisfied with them, do not take kindly to a cylindric correction. On the other hand, we are convinced that the addition of a low cylinder is often the means of abolishing symptoms which have persisted after the wearing of simple spheres. It is no unusual thing for patients to declare that while their former glasses, which were spherical, were helpful, they were still "conscious of their eyes." The introduction of the appropriate cylinder has been attended with the happiest results, often leading to the spontaneous expression, "These glasses are the best I have ever worn."

We must ever be on our guard lest the patient unintentionally misleads us. Our patients are of all grades of intelligence, hence misunderstandings are apt to arise. The success or failure of the test depends in no small measure on a correct understanding by the examiner of the patient's statements, which are often erroneous. Many do not seem to realize promptly the meaning of "horizontal" and "vertical," and in other ways fail to express clearly what they actually observe.

De Schweinitz[1] presents the results of a study of 100 cases of astigmatism contrary to the rule. All were examined under cycloplegia except when glaucomatous symptoms were present. He found nothing particularly characteristic of these inverse astigmatisms, so far as symptomatology was concerned, but reached the conclusion that when horizontal astigmatism exists, we are warranted in correcting fully every particle of the defect that we can render manifest.

Theobald[2] states that inverse astigmatism of even slight degree gives rise to pronounced asthenopic symptoms, and that its correction is attended with decided relief. Furthermore, an eye with this type of error is capable of "hiding it away," so that its detection is more difficult than the detection of perpendicular astigmatism. He believes that the relationship of inverse astigmatism and chronic glaucoma is more than coincidental.

Several writers, among whom are Steiger, Pfalz, and Schön, have noted a progressive diminution of perpendicular astigmatism and an increase in horizontal astigmatism as age advances.

The percentage of inverse astigmatism in school-children was found by Nordenson[3] to be only 1.3. Similar conclusions were reached by Hess on the basis of skiascopic examinations.

In regard to sex as a factor, Pflueger found inverse astigmatism to predominate in females, the ratio being 11:9. An even greater predominance of the female sex is indicated in de

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[1] De Schweinitz, G. E.: "One Hundred Cases of Astigmatism Contrary to the Rule," *The Journal A. M. A.*, 1891, xvii., 359.

[2] Theobald: "Is Astigmatism a Factor in the Causation of Glaucoma?" *Tr. Am. Ophth. Soc.*, 1888, xxiv., 126.

[3] Nordenson: *Ann. d'ocul.*, 1883, lxxxix., 110.

Schweinitz's series, as he found the anomaly present in sixty-nine females and thirty-one males.

The present study is based on a review of all eyes with astigmatism occurring in our private practice from July 1, 1916, to March 1, 1918, a period of twenty months. As stated in the foregoing, all eyes showing an astigmatism of not more than 0.12 D. have been excluded. We have also omitted the few cases in which the principal meridians were at 45 and 135 degrees. There were 1024 eyes which exhibited an astigmatism of 0.25 D. or over. Of these 741, or 72.3% were with the rule and 283, or 27.7% against the rule. The number of patients with astigmatism against the rule was 182, of whom 69 were males and 113 females. This refractive anomaly was present in one eye in 81 patients; it was present in both eyes in 101 patients.

Table 1 displays the incidence by decades. If this eighty-year period be divided into two groups of forty years each, eighty-nine patients belong in the first period and ninety-three in the second.

TABLE 1.—INCIDENCE BY DECADES OF ASTIGMATISM AGAINST THE RULE

Years	Number
0 to 10	0
11 to 20	21
21 to 30	37
31 to 40	31
41 to 50	50
51 to 60	22
61 to 70	13
71 to 80	8

Of the 182 patients, 114 were examined without cycloplegia and sixty-eight with cycloplegia. In the examination of the sixty-eight patients, homatropine, 3%, was used in fifty-one; atropine, 1%, in nine; scopolamine, 0.1%, in six, and euphthalmine, 2%, in two. We recognize, of course, that euphthalmine is not a cycloplegic, but have inserted the two cases here for convenience. Presbyopic correction was required in eighty-seven patients, a fact which explains the relatively large number of patients whose eyes were tested without cycloplegia.

In thirty-one eyes tested with drops, the shadow test failed to reveal the presence of any astigmatism. These were all low astigmatisms associated with a high axial ametropia. It has been our experience that under these conditions low astigmatism often escapes detection by skiascopy. This may account for the failure of some oculists to recognize and correct certain low astigmatisms. Failing to find any skiascopic evidence of the presence of astigmatism, they do not pursue the inquiry any further, but content themselves with a spherical correction. In fifty-nine cases, patients were wearing or presented glasses prescribed by men whom we knew to be ophthalmologists. A neutralization of these lenses showed that in twenty-eight the inverse astigmatism had been recognized; in thirty-one it had not. Thirty patients showed us glasses prescribed by refracting opticians. Neutralization determined the fact that in only four cases was there any recognition of the existence of astigmatism against the rule. An ophthalmometric reading was taken in nearly every case. It is interesting to note that seventy-one eyes gave a reading of 0 and many others indicated low (0.25 or 0.5 D.) astigmatism with the rule.

TABLE 2.—TYPES OF REFRACTIVE ERROR OBSERVED IN TWO HUNDRED AND EIGHTY-THREE EYES

Refraction	No. of Eyes
H + Ah.	180
Ah.	40
M + Am.	35
Am.	7
Mixed astigmatism.	21

The symptomatology was variable and indefinite. The most frequent symptoms were headache, frequently occipital in type, indefinite ocular and retroöcular discomfort or pain, asthenopia and conjunctival and palpebral irritation. In the majority of cases there was an associated axial ametropia, so that it was impossible to be certain whether the symptoms may not have been due in part to hyperopia or myopia, as the case might be. In many patients previously given simple spheres, the addition of the appropriate cylinder was immediately recognized as a great improvement. The relief of symptoms, when the inverse astigmatism was the principal error, was often very striking.

CONCLUSIONS.

1. The percentage of inverse astigmatism is larger than is generally surmised.

2. The preponderance of females in the ratio of about 2:1 was a surprise to us, but is confirmed by the findings of de Schweinitz and others.

3. As has been noted by other observers, inverse astigmatism was not observed in children under 10 years of age.

4. Inverse astigmatism appears to be nearly as frequent from birth to middle age, as from middle age to old age.

5. Many patients tolerate a moderate inverse astigmatism up to the presbyopic age, when symptoms referable to the refractive error first manifest themselves.

6. The detection of inverse astigmatism is at times difficult with ordinary measures and care, often eluding the examining oculist and only in rare instances being detected by the refracting optician.

7. No special symptomatology can be attached to inverse astigmatism, the complaints being diverse and often indefinite.

8. Lancaster's charts have been of inestimable value in the detection of low grades of inverse astigmatism.

A CASE OF ACUTE RETROBULBAR NEURITIS IN A CHILD WITH INTESTINAL STASIS (CONGENITAL DILATATION OF THE COLON).

By Dr. MARK J. SCHOENBERG.

In the afternoon of December 5, 1917, a boy (Kenneth L.), 4 years old, was brought to the Presbyterian Hospital (Dr. Mason's service). He had high fever and had become entirely blind while eating his lunch that same day. His mother related that the child got up in the morning as bright as ever, had played with toys and appeared cheerful and normal in every respect. Just before lunch the mother showed him the picture of a horse and he made the remark that he could not see the legs of the animal. A few minutes later, at the table, he complained that he could not see his dinner. His look became stary but he did not appear sick. He was fed by his mother and ate with appetite. He had no headache, did not vomit, and complained of no dizziness. The face and extremities did not become pale; there were no twitchings or convulsions. He walked (when led) without staggering; his speech and hearing were normal as usual. The mother noticed that the child had high fever during the lunch. A day before he had had a bowel movement consisting of "soft brown stools." Urination was normal.

For the past four weeks the child had been coughing slightly and was given Stokes's expectorant. The medicine was refilled four days before and taken regularly until the day when blindness occurred, when he took the last three remaining doses (a teaspoonful each). The medicine had no ill effect, when taken two weeks before. Except for this mixture the child had taken no medicine, and there are no other drugs or poisons in the home. No drops had been used in the patient's eyes. He had had no falls or injury of any kind.

Family history. Parents and one other child well. Mother never miscarried and there was no history of chronic diseases in the family.

Personal history. Patient is the second child, full term, normal labor, strong and healthy. Bottle fed to thirteen months. No digestive troubles except occasional constipation. Always bright and active.

Previous illness. Measles in July, 1916. Whooping cough March, 1917. No history of tonsillitis, colds, rheumatism. No convulsions or fainting spells. Never had trouble with sight. Climbs stairs easily.

Examination on admission. General appearance. Well-developed, well-nourished child. Moderate dyspnœa and slight cough. Appears blind in both eyes. Expression dull. Occasionally twitching in fingers. Skin normal. Nose, throat, ears, normal. Thorax, lungs normal. Heart enlarged downward. A loud systolic murmur is heard at the apex, which is transmitted to the axilla. Abdomen moderately distended, tympanitic. Firm masses are felt in the left iliac fossa. No tenderness nor rigidity of the abdominal walls. Genitals normal. Extremities show occasional twitchings in the hands. Superficial lymph glands normal. Reflexes normal. No Babinsky, no Kernig. Temperature 102° F. The eyes were examined in the evening, about seven hours after the child had begun to complain of loss of vision. He was bright and could easily be induced to coöperate. He moved his eyes in every direction when told to do so, and showed no impairment of motility; understood very well when he was spoken to, and gave intelligent answers. He could not see even a strong electric light and made no attempt at winking when an object was brought quickly towards his eyes. The corneal reflex was present and normal. The pupils were dilated, equal, regular, and did not react to light. The ophthalmoscopic examination revealed a papillœdema of about 2 D., equal on both sides; the retinal veins were engorged, but the arteries normal in size. No hemorrhages or exudates.

At midnight the patient was quiet, the temperature had reduced to 99.6. The pupils were dilated and rigid to light.

Dec. 6, 1917. 12.15 A.M. Lumbar puncture. 10*cc* fluid removed for examination. Cells 4. Noguchi and Wassermann negative.

1 A.M. Colon irrigation. 1.45 A.M. Patient had a movement, consisting of *several quarts* (!) of very ill-smelling feces. 2 A.M. Pupils less dilated, react readily to light. Patient begins to see, follows the light, counts fingers, and distinguishes a bottle from a cup.

9 A.M. Pupils respond promptly to light; patient recognizes his father at a distance of several feet; distinguishes various objects.

The examination of the urine, blood Wassermann, blood and throat cultures revealed nothing abnormal. The urine did not contain indican.

Chemical blood examination. CO_2 33.25 mgr. Blood sugar .118 mgr. glucose per 100*cc* of blood. Blood urea 0.025.

Blood count.	White bl. corp.	17,600
	Polymorphonuclears	66%
	Small lymphocytes	31%
	Mononuclears	1%
	Transitionals	1%
	Eosinophiles	1%

X-ray skull. Nasal sinuses negative.

Heart. Enlarged, especially to the right. Total transverse diameter 4½ inches.

Eye examination on Dec. 6. Pupils well contracted during sleep. As soon as the child woke up the pupils dilated, but the right pupil remained slightly larger than the left. Fundus. Both disks œdematous but less than the day before. Veins less engorged. The right disk is slightly more raised than the left. The vision, which could only be roughly estimated, consisted in ability to call out the name of a quarter, knife, pencil, when these objects were held at a distance of about two feet. Field of vision good peripherally for movement of hand.

Dec. 7. Again a very unusually large mass of feces after a high enema, mostly constipated, foul smelling masses. Patient feels well. Is cheerful and says he sees better.

Dec. 8. Vision improved, can distinguish a nickel from a quarter at about seven feet distance. Pupils slightly dilated, right slightly larger than left. Fundus. Right disk clearing up; slight œdema nasally. Left disk blurry throughout; swollen to about 1 D. Motility of both eyes normal.

Dec. 16. Boy behaves as if he has a central scotoma. If shown colored pictures of boys or girls he cannot point at the eyes or mouths, although he can readily tell which is a boy or a girl. When told to pick up colored beads or pieces of paper from the floor he will pick up the largest ones, and if urged to pick up the smaller ones he tries to perform his part of the game by feeling around and using the tactile more than his visual sense. He cannot point to where a small 5*mm* piece of white paper is, when held just in front of one of his eyes, but will see it when held to either side.

The patient continued to have very copious (several pints at a time), foul-smelling defecations, in spite of the restricted diet he had in the hospital.

Dec. 22. Vision: recognizes pictures of girls and boys at about six–eight feet distance.

Jan. 8, 1918. Temperature suddenly rose to 103°. Patient's vision seems to be less acute, but could not be measured properly on account of his general condition. A high enema brought about again a very large stool (characterized by Dr. Blood, in charge of the children's ward, as three–four times the amount passed by an average child of this age) and a prompt reduction to normal of temperature and improvement of vision.

An X-ray examination of the intestinal tract showed a redundancy of the sigmoid flexure and of the descending colon. The sigmoid rises to the 3d lumbar vertebra.

A chemical and microscopic examination of the stools by Dr. Dwyer (whom I wish to thank for his kindness) made on Jan. 9, 1918, "revealed a highly acid, extremely toxic stool with evidence of a mild mucous colitis. The bacteria were almost wholly Gram positive."

Jan. 24, 1918. Called at the H. Knapp Memorial Eye Hospital. General condition good. Pupils O. D.>O. S.; react promptly to light and accommodation. Vision: picks up with ease 2 sq. *mm* pieces of red and white paper from the floor and recognizes a penny and a nickel at twenty-feet distance.

Feb. 16, 1918. Fundus. Right disk temporally atrophic. Left disk atrophic and blurry above; inflammatory process not entirely subsided.

March 19, 1918. Vision about $\frac{6}{50}$ in each eye. Fundus same as before.

Summary. This is a case of optic neuritis (retrobulbar type) manifesting itself clinically by a sudden onset of blindness which began to recede very soon after the expulsion of a very considerable amount of feces. The course of the visual disturbance made the impression upon all, who saw and followed up the patient, that the condition was due to an autointoxication of intestinal origin. How near this diagnosis is to the truth is a matter for the reader to decide. We have no means nowadays of proving the existence of an intestinal autointoxication. The presence of intestinal stasis and the coincidence of an optic neuritis does not prove a causal relation between the two, but the rapid reappearance of vision after the very large movement of the bowels is very suggestive of such a relation.

If we think of the other conditions which might have produced in this child the bilateral optic neuritis we have to consider first, bronchitis, possibly an influenza which preceded by a few weeks the onset of the eye trouble; second, the possibility of the presence of wood alcohol in the tincture of opium contained in the Stokes's mixture given to the child for the cough. An infectious disease, like influenza, may give very rarely a retrobulbar neuritis by way of the blood or by way of a nasal sinusitis. In these cases there is usually found a star figure in the macular region and the spinal fluid shows the presence of a mild lymphocytosis (Knapp, *Medical Ophthalmology*), which were not present in our patient. Neither does the vision improve so rapidly after a colon irrigation or spinal puncture in influenza optic neuritis as it did in our patient. The presence of wood alcohol in Stokes's mixture is not probable considering the fact that it was obtained from a well known and reputable New York dispensary. Besides, wood alcohol if taken in sufficient quantity to produce complete amaurosis will give a number of other symptoms, like gastro-intestinal irritation and coma or prostration, which were absent in this patient.

Was the speedy return of sight after the successful colon irrigation due to the removal of the toxic feces only a coincidence? Did the spinal puncture just prior to the enema have anything to do with the return of vision? I do not think so. A spinal puncture may act beneficially upon the central nervous system by relieving momentarily an intracranial pressure and in cases of uremic amaurosis or in delirium tremens the removal of (a good deal more than 10*cc*) spinal fluid may under rare circumstances improve vision or delirium. But in such cases we deal with intoxication of the brain substance itself and increased intracranial pressure. In our patient there was no sign or symptom of increased pressure or disturbed cerebration and the blindness was due to a lesion in the optic nerve, not in the visual centers.

Finally—how could an intestinal stasis like that present in our patient cause an optic neuritis? The mere presence of intestinal stasis and putrefaction is not sufficient to cause the passage of poisons into the blood. The mucosa lining the intestinal tract is the first and a very effective line of defense against autointoxication. Even if intestinal poisons succeed in passing into the circulation they are arrested and made innocuous by the liver, which constitutes the second line of defense. Finally when this barrier is broken down, there seems to be a third line of defense consisting of substances thrown into the circulation by the glands of internal secretion which have a detoxicating function upon poisons of whatever origin entering the blood stream. As we see it, the question of intestinal intoxication and its damaging effect upon certain tissues is not only a matter of absorption of toxic substances from the intestinal tract, but is a subject intimately connected with a number of other very complex problems.

In our case the dilatation of the large intestine (probably congenital) and the stasis and putrefaction of fecal matter must have injured the mucosa and allowed the continuous absorption of intestinal poisons. These must have overwhelmed the other detoxicating organs by their high toxicity, amount, etc., in order to reach the optic nerves. Why the products of intestinal putrefaction in this case affect the optic nerves, in other cases the uvea (see Dr. Dwyer's report in ARCH. OPHTH., vol. xlii., No. 3), is a question which future researches may answer.

I wish to thank Dr. H. H. Mason for permission to publish the report of this case from his service at the Presbyterian Hospital.

CYSTOTOME MANŒUVRE: EXTRACTION OF MATURE AND IMMATURE CATARACTOUS LENSES WITHIN THE CAPSULE.

PRELIMINARY REPORT, FIFTEEN OPERATIVE CASES.

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THE most desirable method of extraction of a senile cataract mature or immature is the one in which the lens in its intact capsule may be delivered with the least danger of loss of vitreous and minimum amount of trauma to eye tissues.

The writer has found that the lens can be rotated on its anteroposterior axis by a cystotome manœuvre and the zonule of Zinn disrupted in its entire circumference, freeing the lens within its capsule from its attachments without risk of loss of vitreous or perceptible additional traumatic effects to the usual extraction.

The intracapsular extraction in vogue at this time is Henry Smith's method in which forcible expression is employed to rupture the ligament of the lens, and even in the hands of the most expert there is a loss of vitreous recorded in a considerable number of the cases operated upon in this way. The post-operative reaction is in excess of the usual extraction because of the additional trauma requisite to dislodge the lens.

There were twelve mature and three immature cataracts in the last fifteen consecutive extractions of senile cataract operations and of this number thirteen lenses were delivered within the capsule. These gratifying results with the following technique in the writer's mind warrant this preliminary report.

After the usual incision and iridectomy upward for the extraction of a senile cataract, the conjunctiva is grasped with fixation forceps two and one half millimeters from the corneal limbus in the lower nasal segment to steady the globe; the tip of the cystotome is then entered at the outer portion of the incision and passed blade flatwise in a downward and inward direction in front of the capsule, then behind the iris, until it has reached the locality of the lens ligament in its lower inner segment; the instrument is then turned at an angle of 90° to engage its sharp point into the capsular tissue near the zonule of Zinn; when this is done a quick jerky movement is executed circularly inward and upward in the direction of the zonule of the lens. The release of the lens in its capsule may be seen if the field of operation is watched closely. When this is accomplished the cystotome is carefully withdrawn blade flatwise, the lens delivered by pressure upon the lower portion of the cornea, pillars of the coloboma dressed down, and bandage applied.

The cystotome used is the type in which a spear point is fixed at the extreme tip of a round slender flexible shaft and at right angles to it. The sides of the spear point are equal and each measures 1*mm.* The entire length of the instrument is 123*mm* and consists of a shaft 27*mm* and handle 96*mm.* The shaft may be bent to meet the demands of the case to be operated upon.

The ligament of the lens was probably not entirely disrupted in the two cases in which the cystotome manœuvre failed because by pressure upon the lower corneal area by a spoon and pressure above the corneal incision at the same time the lens did not present. In these cases I reëntered the cystotome and did the usual incisions of the anterior capsule, delivered the lens but the capsule remained. In one other case succeeding these the lens failed to present also after the cystotome manœuvre and instead of incising the capsule as in the two cases just cited I entered the point of the cystotome in the ligamentary region at the margin of the outer pillar of the coloboma and made the same quick manœuvre with the cystotome but in the opposite direction, that is toward the inner pillar of the coloboma. The lens was freed and presented readily in the corneal wound by gentle pressure upon the lower portion of the cornea and was delivered in its capsule. In the future I will try this before I proceed to the incisions of the anterior capsule.

Three of the cataracts of this series were immature and were delivered within the intact capsule. Two were delivered without accident. In expressing the other one the capsule burst when the lens was in the corneal incision and almost delivered. Some of the liquid clear cortex remained in the anterior chamber and the chamber was gently and thoroughly flushed. Four days afterwards a few small opaque lenticular spots were visible at the margin of the dilated pupil below but none appeared in the line of direct vision. There was no observable vestige of the capsule remaining.

The subsequent healing and convalescence of eyes operated upon with this technique differed in no particular from operations in which the lenses were delivered following incisions made into the anterior capsule. A failure to accomplish the disruption of the lens ligament by this cystotome manœuvre would not be serious because incisions may still be made into the anterior capsule according to stated methods and the extraction completed in the usual way.

Iritis did not develop and there was no loss of vitreous in any of the eyes operated upon in this series. The visual results with correcting lenses were as follows: $\frac{20}{50}$ in two, $\frac{20}{40}$ in one, $\frac{20}{30}$ in three, and $\frac{20}{20}$ in seven of them.

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A SIMPLE ELECTRICAL DEVICE FOR ILLUMINATING THE FIELD OF OPERATION IN OPERATIONS ON THE EYE, NOSE, AND THROAT.

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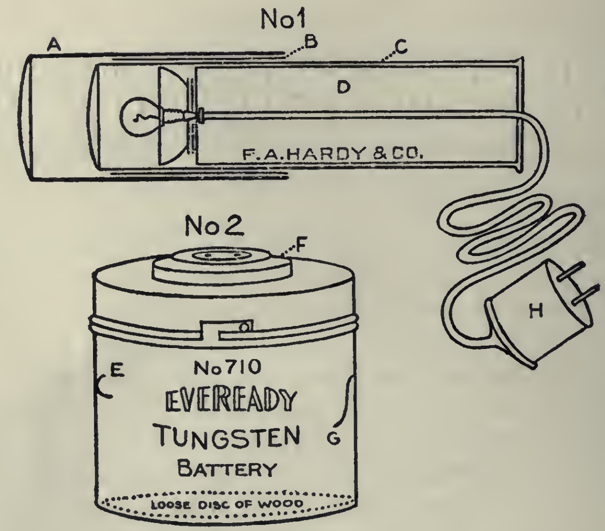
(*With one illustration in the text.*)

THIS simple and inexpensive device is quite adequate for illuminating the field of operation in cataract extraction and other operations on the eye requiring concentrated light. Especially useful is one of these devices in operations for secondary cataract, and other operations on the eye where perfect illumination of the field of operation is so essential in enabling the surgeon to guide his knife and to carry out effectively the toilet of the eye, which is indispensable to satisfactory results.

No. 1 consists of an ordinary flashlight to which has been added the sliding brass tube A, carrying, at one end, a plano-convex lens by means of which the rays of light may be changed to suit the case. B is a strip of felt enveloping the barrel, which enables the tube A to slide smoothly over the parts beneath. For the one-cell battery supplied with these flashlights, I have substituted a core of wood through the center of which passes a wire which makes contact at one end with the lamp, and at its other end carries a cord of any desired length, connecting it, by means of a plug, with a 710 "Eveready" five-cell battery. The lamp used is a tungsten 6.2 V. which is obtainable of any electrical supply company. The receptacle for the battery I had made by a tinsmith. The lid of the receptacle has a bayonet fastening which insures contact with the battery. The Bryant Jr. flush receptacle in the lid of the receptacle which receives the plug may be obtained of any electrical supply company. The instrument maker will supply a nickel-plated brass receptacle which will be more ornamental.



No. 1. A, Brass tube with plano convex lens: $3\frac{1}{2}''$ long, $1\frac{11}{16}''$ in diameter. B, Felt. C, Tube of flashlight: $8\frac{5}{8}''$ long, $1\frac{9}{16}''$ in diameter. D, Core of wood.

No. 2. Receptacle for battery: $3\frac{7}{8}''$ deep, $4\frac{1}{16}''$ in diameter. E, Brass to hold battery in place. F, Bryant Jr. flush receptacle for plug H.

The battery may be used in connection with Phillips's electric head light or any similar head light. The Phillips head light carries a lamp of a special make, not readily obtained, which costs $1.50. I have changed the socket in the head light to receive an ordinary 6.2 V. tungsten lamp[1] which costs 15c. to 25c. and which is entirely satisfactory for all operations on the eye, nose, and throat.

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[1] F. A. Hardy & Co., 15 West 36th Street, New York City, will furnish these devices.

A VARIATION IN THE DISTRIBUTION OF THE NERVUS ABDUCENS IN MAN.

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(*With two illustrations in the text.*)

THE eye muscles and their nerves present one of the most constant features of vertebrate anatomy. Neal (1914) writes:

> " In the great majority of vertebrates the number and nerve relations of the eye muscles remain unchanged. Nature seems to have pursued with regard to them the policy of 'letting well-enough alone.' Their 'evolutionary potential' appears to be approximately zero."

From the dogfish to man one finds six pairs of muscles innervated by three pairs of nerves and the distribution, save in a few rare cases, is always as follows:

M. rectus superior }
M. rectus medialis }
M. rectus inferior } Nervus oculomotorius
M. obliquus inferior }
M. obliquus superior—Nervus trochlearis
M. rectus lateralis—Nervus abducens

Some few deviations from the above arrangement have been pointed out in literature. Thus Allis (1897) states that in Petromyzon the abducens innervates the inferior as well as the lateral rectus, while the third nerve supplies only the rectus superior, rectus medialis, and obliquus inferior. Johnston (1905) says that in Petromyzon the "posterior rectus" (lateral rectus) is innervated by a separate slip of the motor trigeminus which corresponds to the so-called abducens. The other muscles are innervated in the usual manner. However, Neal

(1914) states that there is no abducens and no "posterior rectus" (lateral rectus) in this form and cites Johnston (1905), who does not make such a statement, as his authority. The final word has yet to be said, therefore, concerning the muscles and nerves in the Cyclostomes.

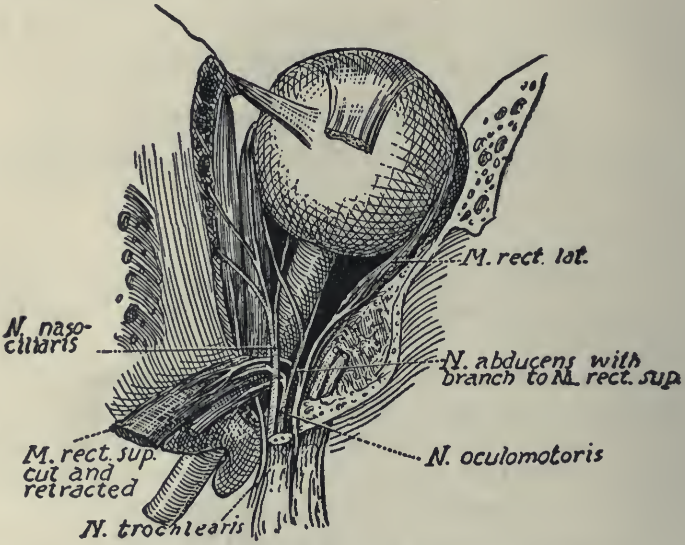
M. rect. lat.
N. naso-ciliaris
N. abducens with branch to M. rect. sup.
N. oculomotoris
M. rect. sup. cut and retracted
N. trochlearis

FIG. 1.—Showing a branch of the N. abducens to the rectus superior muscle.

In Astroscopus (Neal, 1918) some of the eye muscles are transformed into electroplaxes and in the reptiles and some mammals a retractor bulbi (oculi) is found as a derivative of the lateral rectus (Johnson, 1913, Fraser, 1915).

In man only a very few abnormalities have been reported in the innervation of the eye muscles. In Quain's *Anatomy* one finds the following statements concerning such variations:

"A communication between the third and sixth nerves as they pass the cavernous sinus has been described, but its existence has been denied by most recent observers. The upper division of the third nerve may have a communication with the nasociliary (Svitzer, Soemmering, Testut). The third nerve has been seen in a few cases giving a branch to the external rectus (Cruveilhier, Faesebeck, C. Krause), and in one instance a branch of the third supplied the place of the sixth nerve which was wanting (Generali). A filament to the superior oblique muscle was seen by Arnold to pass through the lower part of the ciliary ganglion, and by Henle to pierce the inferior rectus.

" In one case the fourth nerve pierced the levator palpebræ superioris on its way to the superior oblique (G. D. Thane). The nerve has been observed in several cases sending a branch forwards to the orbicularis palpebrarum muscle, or to join the supratrochlear, the infratrochlear, or the nasal nerve. A communication with the frontal nerve is recorded by Berté, and A. F. Dixon found it in a human embryo.

" Absence of the sixth nerve upon one side is recorded, its place being supplied by a branch of the third nerve (Generali)."

In a recent dissection of the head of a male negro, a rather interesting abnormality was encountered on the right side. The abducens, at about the level of the upper division of the third nerve, sent a branch, which accompanied that of the oculomotor, to the superior rectus muscle. This branch of the abducens passed into the superior rectus after passing between the oculomotor and nasociliary nerves. The branch was as large as that to the same muscle from the third nerve. On the left side no variations were noted. The lateral rectus and the superior rectus were of normal size.

In trying to find an explanation for this curious phenomenon one may examine the embryology of the eye muscles and their early relations to their nerves. Neal (1918) sums up the data on the subject in the following words:

"From the first or pre-mandibular head cavity arise the muscles innervated by the oculomotor nerve, namely the recti superior, anterior (medial), and inferior, and the inferior oblique; from the second or mandibular myotome are differentiated the superior oblique muscle and the lateral portion of the external rectus; from the third head cavity develops the median portion of the external rectus muscle."

Figure 2a illustrates the normal origin and innervation of these muscles while Figure 2b shows the condition found in the specimen herein reported. One could not believe the muscles to have arisen on the right side of this specimen in any way save the normal. It is very hard to see how any other explanation for the variation can be had except along the line of the recent work of Parker (1910) who believes in the primary independence of muscle and nerve. From the work of Harrison (1910) this hypothesis gains in weight, for

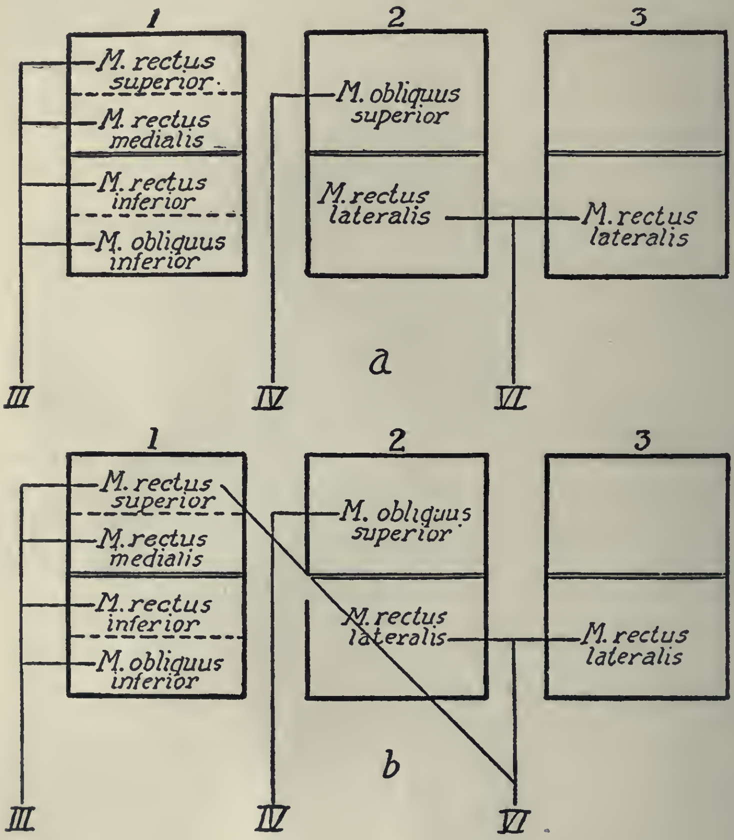

Fig. 2.—(*a*) Showing the normal method of innervation of the eye muscles. 1, 2, 3 are the first, second, and third myotomes, each of which is divided into a dorsal and ventral half. The muscles arising from each half are indicated.

(*b*) Showing the abnormal method of innervation in the specimen reported in this paper.

he has shown how isolated nerve filaments may grow into various types of tissue.

It is not unlikely, therefore, that this particular abnormality arose long after the eye muscles were differentiated and came about as the result of some kind of stimulation to the nerve, which, as a response, sent out fibers to the external rectus. In the light of Harrison's observations one may accept such an explanation rather than assuming some embryological variation, and the conclusions of Neal on the origin of the eye muscles are in no way attacked by finding a case in which a nerve normally supplying a ventral moiety came to supply a dorsal moiety from another somite.

From the standpoint of the ophthalmologist such abnormal innervations are important, for they explain abnormal eye motions in certain cases and may be useful or detrimental in transplantations of the eye muscles, according to the variation present and the type of transplantation done.

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Note:—Since preparing the manuscript for this paper the author has received a note of explanation from Dr. H. V. Neal, in regard to the statement made concerning the eye muscles and eye muscle nerves of Petromyzon. Dr. Neal writes: "The statement in my '14 paper quoted in your letter of Sept. 19 which has just reached me here is very evidently a slip of the pen. What I should have written upon the authority of Johnston was that Cyclostomes have no Abducens nerve. This statement seems to me to be justified by all the facts which we now have." The author wishes to leave the matter at this point and refers the reader to the original papers for further discussion.

THE EYESIGHT OF THE NEGROES OF AFRICA.

By Dr. J. N. ROY.

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DURING a recent tour of study throughout the Dark Continent, where I visited twenty-two different colonies, I had the opportunity of examining the anatomical, physiological, and pathological condition of about five thousand negroes of one hundred different tribes, and it is the result of my researches on their eyesight that I intend to report in this paper.

After dealing with the question of refraction, vision during the day and night and accommodation, I will rapidly compare the eyes of the blacks with those of the other races of the earth.

In my work I used the de Wecker chart—built on the same principal as the Snellen type—in which the smallest characters are normally perceived at the distance of five meters. My subjects being illiterate, I had to use the special chart made up of a certain number of squares of different dimensions, where one side left out represents the opening of each square. In this way my examinations were very simple and precise. Even the least intelligent could easily indicate with his hand the opening of the squares.

I used skiascopy for the refraction. Under the circumstances, the difficulty of transporting the ophthalmometer would not have been repaid by the services obtained from it.

The African light is very bright and the atmosphere very clear. Experiments led me to the conclusion that vision in the same person is better in Africa than in Europe. An emmetropic eye which, in the northern countries, has with good light a vision of $\frac{5}{5}$ or even $\frac{6}{5}$, can see in Africa one meter farther away, *i.e.*, a vision of $\frac{7}{5}$. This unity of $\frac{7}{5}$ will, in this paper, be considered as the normal vision of a European in Africa or in the tropical countries.

A glance at the geography and ethnology of the Dark Continent shows that the different races came in contact according to certain circumstances worth mentioning. The negroes of the Senegal Soudan intermarried with their neighbors of the north, the Berbers and the Arabs and their offspring the Moors peopled chiefly Mauretania. Those of the northeast were gradually absorbed by the Egyptians, who were always at war with the Ethiopians, and their union with the Fellahs gave origin to the race of the Peuhls and the Foulahs who live in the neighborhood of the Senegal River, the upper part of the Niger and in the Fouta Djalon in French Guinea. The Arabs of Yemen made repeated incursions into Africa, crossed the coast of Somalis, and reached Harar the capital of the country of Gallas in Abyssinia where they remained in possession for a long time.

The negroes who came in contact with these different races inherited from them many diseases, chiefly syphilis and trachoma. I shall, at a later date, take the opportunity of dealing with this question of syphilis on that continent. Smallpox also made terrible ravages chiefly where the means of communications are naturally easier than in the wild forest. The same may be said of purulent ophthalmia. In a general way the eyes of the people living north of the fifth degree latitude north are not as good as those living south, on account of the lesions due to purulent ophthalmia, variola, trachoma, and the constant irritation of the sand.

Strabismus, due usually to corneal scars or amblyopia from other sources, is also more frequent in the northern part.

I made a complete tour around the African continent penetrating at many points even to a great depth. My conclusions are in a word that the people of the south were first infected by those of the north, who in turn had been contaminated by the Indo-Europeans.

It would be outside the sphere of this paper, even on the point of view of the union of races and the resulting contagion, to deal longer with this continent which in the past probably bound Asia and the south of Africa and of which the islands of the Sonde are the vestiges. The Hottentots and the Bushmen with their Mongolian blood are a living proof of this hypothesis. The last descendants of these tribes, almost extinct nowadays, live grouped together chiefly on the frontiers of Rhodesia, German Southwest Africa, and the Portuguese Angola.

Upon close examination of the eyes of the negroes, one is astonished at the considerable amount of pigment contained therein. At times it is even found on the ocular conjunctiva opposite the external canthus. The iris and the choroid are saturated with it and even in certain cases there is a physiological condition of melanosis of the soft palate and of the gums.

Refraction shows that their eyes are almost all emmetropic, provided there is no alteration of the cornea due to previous diseases. My statistics have given me the following results. Simple myopia is found in the proportion of about 1.5 per 100 and then it is always of a mild degree. I never had to use a glass higher than four diopters and this was with albinos. In passing it is worthy of note that this pigmentary anomaly is far more frequent in Africa than elsewhere. In Nigeria I saw a family of the tribe of Yorubas composed of five children, one dark and four albinos. It would have been interesting to find out, on the point of view of progeny, if the albinos intermarried, but in spite of a most careful inquiry, it was impossible to establish that fact, on account of the way they are treated in their own villages. At places they have no prestige, at others they are considered as unlucky, sometimes sacrificed at their birth or regarded as fetish.

Myopic astigmatism is found in about the same proportion as simple myopia, *i.e.*, 1.5 per 100 and I never had to use a cylinder higher than −2.5 to correct the error.

There is an absence of keratoconus and keratoglobus in Africa.

Simple hypermetropia and hyperopic astigmatism are found in about 2.5 per 100. The highest degree of hypermetropia was corrected by a sphere of + 3.5 and astigmatism by a + 2.5

cylinder. I saw but few cases of compound astigmatism and those chiefly among albinos. I never had a case of mixed or irregular astigmatism.

All these percentages are based on cases with absolutely transparent corneas. It goes without saying that alterations of the cornea due to diseases are met with in Africa as elsewhere. These percentages are based on an average of the whole continent. Where schools of instruction have long been established, they may be too low, but at places where almost every one was emmetropic, they are certainly too high. Practically all cases of ametropia were corrected by very weak glasses.

In a general way, I have been surprised at the excellent eyesight of the negroes. In rare cases, I have even observed that a correction of two to three diopters of either hypermetropia or myopia could improve their vision up to $\frac{9}{5}$ and even $\frac{11}{5}$. The highest normal vision recorded was one of $\frac{20}{5}$ and this was in a man affected with sleeping sickness. I shall, in a later paper, deal with this disease and show the great resistance of the negroes' eyes to the human trypanosomiasis. My statistics show that the average vision of the natives of Africa is $\frac{12}{5}$. More than any other race, have they the faculty of seeing to a great depth in water. In spite of the most careful researches, even in eyes suffering from diseases, I have never observed any alteration of the color vision or hemianopsia.

It is with pleasure that I mention my gratitude to our confreres of all nationalities with whom I came in contact. Their organization of all kinds have been a great help to me in my researches.

The negroes have a great power of vision in the dark. I made a series of experiments to compare their sight at night with ours. The subjects, both Europeans and natives, were first refracted and all ametropic or diseased cases were eliminated. To be understood by all, I had to proceed in the following simple manner. I made with white paper certain figures representing a square, a cross, or letters like L, I, V, T, etc. These figures were placed on a blackboard. The group to be examined stood far from these objects, the Europeans on the right and the natives on the left. A period of one minute was allotted at each distance. If at the end of that time none of the group could see, all moved forward one step and so on. When any one could recognize the object, he was led aside and had to describe in some way the figure seen. If he was right, the distance at which he could see was measured; if not, he had to rejoin the group. In this way, I calculated the distance at which everyone could recognize the object. I repeated the test with the different figures. My experiments, repeated frequently and at different places, show that the negroes see at night from two to four times better than the whites. Admitting this fact, what is the explanation? A number of enucleations has given me the material for histological researches chiefly on the retina. The comparative anatomy of the eye shows that it is in the rods of the retina that lies the difference between the diurnal and the nocturnal animals.[1] Schultze had expressed the opinion that the latter had no retinal cones. Later this was found to be erroneous, as most of the reptiles, who are nocturnal, have more cones than rods. Up to now the only difference found is that the nocturnal animals have longer and thinner rods than the diurnals. I paid special attention to the examination of the retina. Unhappily the histologists I consulted found nothing new on the subject. There was a larger amount of pigment in the eyes of the negroes than in those of the whites, but rods in both races have the same form. We are forced to believe that their excellent vision in the dark is due to their greater use of their eyes at night compared to us. I have noticed the same thing with the Indo-Chinese, the Malays, redskins, whose vision at night is very good, and even among the Hindoos whose origin is Aryan.

I paid particular attention to their power of accommodation. It was easy to have positive facts on account of the presence, at different places, of scholars who could read fairly well. My researches on the subject show that the natives of the Dark Continent have a better power of accommodation than the whites, according to the standard given by the figures of Donders which I will discuss later on. A study of a series of fifty observations from my statistics show without doubt the existence of this superiority and, besides, corroborates all our previous statements. These observations are practically alike and were all made on emmetropic cases. To get the *punctum proximum* I used the smallest characters of the de Wecker chart. The optometer with thread would have given results hard to control.

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[1] J. N. Roy. "Anatomie et physiologie comparées de l'œil et de ses annexes," *Archives d'Ophtalmologie de Paris.* Juillet–Août, 1912.

Obs.	I.	Man	tribe	Ouolofs	16	years	amp.	acc. 0.07	cent.	= 14.28	diopt.	Em. V	= 14/5
"	II.	"	"	"	18	"	"	" 0.082	"	= 12.19	"	Em. V	= 12/5
"	III.	"	"	Bambara	17	"	"	" 0.08	"	= 12.5	"	Em. V	= 13/5
"	IV.	"	"	Mandingue	29	"	"	" 0.107	"	= 9.34	"	Em. V	= 12/5
"	V.	"	"	"	15	"	"	" 0.068	"	= 14.7	"	Em. V	= 10/5
"	VI.	"	"	Bambara	20	"	"	" 0.085	"	= 11.76	"	Em. V	= 15/5
"	VII.	"	"	Malinke	22	"	"	" 0.088	"	= 11.36	"	Em. V	= 12/5
"	VIII.	"	"	Soussous	24	"	"	" 0.09	"	= 11.11	"	Em. V	= 12/5
"	IX.	"	"	"	30	"	"	" 0.103	"	= 9.7	"	Em. V	= 11/5
"	X.	"	"	"	23	"	"	" 0.09	"	= 11.11	"	Em. V	= 12/5
"	XI.	Woman	"	Fantis	14	"	"	" 0.067	"	= 14.92	"	Em. V	= 16/5
"	XII.	"	"	Apollonienne	14	"	"	" 0.07	"	= 14.28	"	Em. V	= 12/5
"	XIII.	"	"	Fantis	13	"	"	" 0.065	"	= 15.38	"	Em. V	= 15/5
"	XIV.	"	"	Accra	15	"	"	" 0.072	"	= 13.88	"	Em. V	= 11/5
"	XV.	"	"	Achantis	22	"	"	" 0.084	"	= 11.9	"	Em. V	= 9/5
"	XVI.	"	"	"	18	"	"	" 0.77	"	= 12.98	"	Em. V	= 14/5
"	XVII.	"	"	Yoruba	29	"	"	" 0.106	"	= 9.43	"	Em. V	= 11/5
"	XVIII.	"	"	Ibos	20	"	"	" 0.088	"	= 11.36	"	Em. V	= 14/5
"	XIX.	"	"	Egbas	22	"	"	" 0.08	"	= 12.5	"	Em. V	= 15/5
"	XX.	"	"	Yoruba	25	"	"	" 0.102	"	= 9.8	"	Em. V	= 10/5
"	XXI.	Man	"	Minas	23	"	"	" 0.085	"	= 11.76	"	Em. V	= 14/5
"	XXII.	"	"	"	23	"	"	" 0.08	"	= 12.5	"	Em. V	= 17/5
"	XXIII.	"	"	Evhe	25	"	"	" 0.087	"	= 11.49	"	Em. V	= 18/5
"	XXIV.	"	"	Dagomba	19	"	"	" 0.07	"	= 14.28	"	Em. V	= 11/5
"	XXV.	"	"	Fons	19	"	"	" 0.075	"	= 13.33	"	Em. V	= 10/5
"	XXVI.	"	"	Bassa	23	"	"	" 0.073	"	= 13.69	"	Em. V	= 14/5
"	XXVII.	"	"	Malumba	21	"	"	" 0.07	"	= 14.28	"	Em. V	= 15/5
"	XXVIII.	"	"	Kumba	24	"	"	" 0.082	"	= 12.19	"	Em. V	= 13/5
"	XXIX.	"	"	Malumba	21	"	"	" 0.074	"	= 13.51	"	Em. V	= 10/5
"	XXX.	"	"	Bassa	18	"	"	" 0.07	"	= 14.28	"	Em. V	= 12/5
"	XXXI.	"	"	Loango	16	"	"	" 0.07	"	= 14.28	"	Em. V	= 10/5
"	XXXII.	"	"	Yacoma	13	"	"	" 0.067	"	= 14.92	"	Em. V	= 13/5
"	XXXIII.	"	"	Batetela	16	"	"	" 0.065	"	= 15.38	"	Em. V	= 10/5
"	XXXIV.	"	"	Azande	15	"	"	" 0.075	"	= 13.33	"	Em. V	= 12/5
"	XXXV.	"	"	Bangala	16	"	"	" 0.075	"	= 13.33	"	Em. V	= 11/5
"	XXXVI.	"	"	Yacoma	15	"	"	" 0.07	"	= 14.28	"	Em. V	= 15/5
"	XXXVII.	"	"	Basonge	14	"	"	" 0.065	"	= 15.38	"	Em. V	= 11/5
"	XXXVIII.	"	"	Bangala	15	"	"	" 0.068	"	= 14.7	"	Em. V	= 12/5
"	XXXIX.	"	"	Bakumu	15	"	"	" 0.075	"	= 13.33	"	Em. V	= 10/5
"	XL.	"	"	Basoko	14	"	"	" 0.062	"	= 16.12	"	Em. V	= 12/5
"	XLI.	Woman	"	Baluba	14	"	"	" 0.068	"	= 14.7	"	Em. V	= 12/5
"	XLII.	"	"	Mongo	18	"	"	" 0.074	"	= 13.51	"	Em. V	= 11/5
"	XLIII.	"	"	Yacoma	17	"	"	" 0.07	"	= 14.28	"	Em. V	= 15/5
"	XLIV.	"	"	Basoko	15	"	"	" 0.066	"	= 15.15	"	Em. V	= 17/5
"	XLV.	"	"	"	20	"	"	" 0.08	"	= 12.5	"	Em. V	= 10/5
"	XLVI.	"	"	Bangala	14	"	"	" 0.06	"	= 16.16	"	Em. V	= 13/5
"	XLVII.	"	"	Bapoto	16	"	"	" 0.065	"	= 15.38	"	Em. V	= 12/5
"	XLVIII.	"	"	Mongo	16	"	"	" 0.068	"	= 14.7	"	Em. V	= 14/5
"	XLIX.	"	"	Basoko	19	"	"	" 0.07	"	= 14.28	"	Em. V	= 11/5
"	L.	"	"	Loango	15	"	"	" 0.063	"	= 15.87	"	Em. V	= 10/5

If we compare these figures with those of Donders's chart, we see to what point the amplitude of accommodation in the negroes is superior to that of the whites, although I must say that the difference is not as marked as it looks. I regret very much I had to limit my researches to the period of life between

13 and 30 years. Younger than that, my subjects could not read sufficiently to give definite answers, and after that I could not trust their age. The negroes cannot give exact answers about their birthday. At times they will mention a certain number of years before or after a definite event in the history of their country, and from this event, as well as we know it, we have to deduce their age. I regret it so much more as it would have been interesting to know when presbyopia develops among them. However our limited statistics with subjects whose age was well known, show that it develops a little later than in the whites. It is but logical on account of their excellent power of accommodation and the rarity of latent hypermetropia. This fact is worth mentioning because according to some authors among whom are H. Campbell Highet of Singapore, and J. Santos Fernandez[1] of Cuba, who have made some experiments in their own country, presbyopia would appear from five to six years sooner in the tropics than elsewhere, and this not only among the Europeans who have been residents for a certain time, but also among the natives. According to them the high temperature, causing a general depression of the organism, and indirectly a diminution of the power of accommodation, would explain this phenomena; besides the way of living and the feeding of these different people could also have something to do with this condition. It is not so with the negroes. Moreover I must say that the population of Singapore is composed of many nations in which the yellow element represented by the Chinese, the Japanese, and the Malays predominates. In Cuba there are Spaniards, Creoles, Chinese, Americans, and the other residents have lost, either as a result of their prolonged stay or through intermarriage, a part of the characteristics of their own race. These anæmic whites or yellow peoples often affected by malaria, or born from diseased parents, are from every point of view far less resistant than the blacks whose organism by heredity is used to the life in the tropics.

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[1] J. Santos Fernandez, "Influencia del clima de la Isla de Cuba en las enfermedades de los ojos," *Cronica Medico-Quirurgica de la Habana*, September, 1893.

"La presbiopia en la Isla de Cuba," *Cronica Medico-Quirurgica de la Habana*, Mayo, 1898.

In Africa I was surprised at the excellent power of accommodation compared to the figures of Donders and upon my return to Canada, I thought it would be interesting to make a control test of these figures. From schools of both sexes and from my private and hospital practice, I examined a great number of persons of different origin whose ages varied from 10 to 60 years. My results lead me to say that the amplitude of accommodation among the whites is greater than the Donders chart would show. In these experiments the de Wecker chart was used and the patients were asked to read, with one eye at a time, the smallest characters at the shortest distance. My conclusions are as follows: from 10 to 15 and from 50 to 60 years, my figures correspond to those of Donders; from 15 to 20, there is an increase in the amplitude of accommodation of one diopter; from 20 to 30, of two diopters; from 30 to 40, of three diopters; from 40 to 45, of two diopters, and from 45 to 50, of one diopter. Emmetropic cases only were examined, as the myopics and the hypermetropics would have given results either higher or lower than the Donders chart which represents only the physiological accommodation.

If we examine, in a general way, the vision among the different races of the globe, we see that it varies greatly in individuals of the same origin. To avoid repetitions and especially to remain on purely scientific ground, I shall divide, as I did in a paper on Ozæna, delivered before the French Congress of Oto-Rhino-Laryngology, in May, 1914,[1] the different peoples of the earth, from an ethnological standpoint, into three large families: the white, the black, and the yellow. Indeed, if we consider carefully the characteristics of the Malays and the redskins, we find that the representatives of those two races have had the Mongolians for ancestors. The color of their skin, the shape of their eyelids, the development of their malar bones, the flattening of the base of their nose, the thickness of their hair, and generally speaking their facial expression, are all arguments in favor of this theory. Moreover, we find in the language of certain Indian tribes of South America, a number of expressions very similar to some Japanese words, and in Mexico, ruins of temples have been found with symbols which are undoubtedly vestiges of those who adorned the shrines of Buddha.

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[1] J. N. Roy, "Ozæna among the Various Races of the Earth," *The Laryngoscope*, St. Louis, September, 1917.

It is not my intention to speak at length of the vision of the whites, it is too well known for that; I will simply point out the most interesting facts not yet mentioned and the results of my observations when their blood is mixed with that of negroes or of Mongols.

It is admitted that in Europe the errors of refraction depend on the races and on the degree of instruction, and as an example of that, we see that myopia is more frequent in Germany than elsewhere, while the Latins and chiefly the Anglo-Saxons in spite of their refined and advanced culture, are less predisposed to it. The same is noticed among the yellow peoples not only of Asia but where ever else my many trips have permitted me to study it locally.

Myopia quite frequent in Japan and China is met with almost exclusively among the educated class and in spite of what certain authors say, it is not a national defect. Hypermetropia is met with a little more frequently.

The Malays, Filipinos, Hovas, Esquimaux, Laplanders, and the redskins are like the negroes, almost all emmetropics, and Steiner[1] has the same opinion of the population of Java.

My statistics on the ametropia of the mulattoes and the half-breeds show that the vision in both has about the same characters. Seventy-five of the refracted cases among the mulattoes are astigmatics. In detail the percentage is as follows: 50% of hypermetropic astigmatism both simple and compound, 25% of myopic astigmatism simple and compound, 20% of hypermetropia and 5% of myopia. Dr. Jones[2] of Newport News, Virginia, in a paper on refraction of the half-breeds comes to the same conclusion. His figures show 78% of astigmatics of which 51% is of the simple or compound hypermetropic type, and 27% of the simple or compound myopic one. There is 19% of hypermetropia and 3% of myopia. The word "Indians" in this paper means half-breeds only. It does not include the redskins, for nowadays these are seldom met with in their pure condition. To study them carefully, one has to go, as I did, to Mexico or to Central or South America.

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[1] L. Steiner, "Coup d'œil sur 3104 cas de maladies des yeux chez les Malais," *Geneeskundig Tydschrift voor ned. Indie*, xxxvi., I.

[2] C. P. Jones, "A Study of One Hundred Refraction Cases in Indians Fresh from the Plains," *The Journal of the American Medical Association*, July 25, 1908.

No irregular or mixed astigmatism was found among the mulattoes or the half-breeds and all the corrections were of a slight degree.

Some authors have put forth the opinion that the depth of the orbit might have some influence on the development of the eye in its anteroposterior diameter and consequently affect the refraction. To deep orbits would correspond myopia and to shallow ones, hypermetropia. Moreover they think that the orbital diameter is in relation with the shape of the head and that the more dolichocephalic is the cranium, the deeper is the orbit and vice versa. We know that in a general way, the yellow peoples are more or less brachycephalic, the whites mesaticephalic, and the negroes almost all dolichocephalic. My prolonged studies among the main races of the earth has shown me the falsity of this theory. Outside of the anomalies of refraction, due to abnormal curvature of the lens or to previously existing diseases which, by softening the posterior segment of the eye, alter its anteroposterior diameter, there is no rule to explain the causes of ametropia other than direct heredity. These hereditarily weak eyes succumb to the effect of fatigue brought on by delicate work, corneal lesions, defective light, and the constant use of poor printing. Moreover according to Broca's measurements of the orbit the Dutch with their shallow cavities are frequently myopics, while the Esquimaux with their large orbits are almost all emmetropics.

The vision of the different peoples is also proportionate to their intellectual development. Taking the white race as a point of comparison, we see that the eyesight of the Chinese and the Japanese is similar to ours and of all the different branches of the yellow race, it is the worst. The Esquimaux and the Laplanders, living in the northern countries, are next in scale with a vision superior to that of their ancestors. The Filipinos, Hovas, Malays, and the redskins have still better sight.

Warm climate seems to have a certain influence on the development of the ocular pigment. In individuals of the same race born in different places, more pigment is met with in the tropics than in the cold countries. As a result of this, there is a larger absorption of light rays and an improvement of the sight, although I must say that the intensity of the light plays a great part.

Studying the moral and the physical condition of the mulattoes and the half-breeds, we find that they inherited from the whites all their defects and even their patrological atavism. When the good qualities exist—which is exceptional—they are always poorly developed. Their eyes are not as good as those of the redskins and the negroes, but may be compared to ours.

The power of accommodation of the yellow race is—as in the whites—superior to the figures of Donders. My statistics show it about equal in both races. The same may be said of the mulattoes and the half-breeds.

In concluding, let me once more call to your attention, the marvelous visual apparatus of the negroes, as compared with that of the other peoples who live in a more or less primitive state, or who have reached the highest degree of civilization. After careful researches, I came to the conclusion that the higher the human being rises in the social scale, the more his brain develops at the expense of the organs of sense, chiefly of vision and of hearing, both of which can be estimated mathematically.

For the whites, their mode of life has a deleterious influence on their physique. The hygiene of the sight and hearing is defective on account of the use of strong artificial light and injurious noises. Diathesis is transmitted from generation to generation. In general, feeding is too heavy and too rich. Excesses of all kinds ruin the organism, and the needs of instruction require prolonged and tiresome studies.

None of these are found among the natives of Africa. They live the simplest life required by the most urgent needs of nature and they have no ambition. Of all human beings the blacks are without doubt the ones representing the lowest step of civilization. Their eyes and ears are developed to the highest possible degree of physiological function. Next in the scale are the yellow peoples of the islands of Oceania, then those of Indo-China, the redskins of Mexico, of Central and South America, the Laplanders, the Esquimaux, and lastly the Chinese and the Japanese. The whites are the last in the scale with a poor vision compared to the other races, and even among them it is influenced, as I have said previously, by the degree of instruction and heredity.

The ocular pigment seems to have a definite influence in the perception of the objects and I believe that in the negroes, it is one of the main agents of their excellent vision. It absorbs some rays of light and neutralizes the ones that are irregularly reflected on the retina.

With the civilization brought to them by the Europeans who now control almost the whole of Africa; with their mode of living changed chiefly in the increased absorption of a more or less adulterated food and of the alcoholic beverages—which nowadays they even make themselves;—with the advance of instruction in schools and workshops; with at places the use of artificial light, it is a question how long will these natives keep up their visual power, at present so perfect.

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By JOHN M. WHEELER, M.D., Secretary.

MONDAY EVENING, APRIL 15, 1918. MARTIN COHEN, M.D., CHAIRMAN.

Dr. W. E. Lambert presented two cases that he had operated on for **congenital dislocation of the lenses**—brother and sister. The mother also had dislocation of the lenses, but not sufficient to interfere with her vision. The boy before operation had $\frac{4}{200}$ vision in the right eye and $\frac{20}{200}$ in the left. The girl $\frac{20}{70}$ in the right, and fingers in the left. Four discissions were made on each eye in both cases, and the entire treatment and subsequent absorption of the lenses lasted about six months. The result in each case was most satisfactory, as the lenses were entirely absorbed. The girl's vision is $\frac{20}{30}$ plus in each eye, with + 12.00 spherical. The boy has $\frac{20}{50}$ V. O. D. and $\frac{20}{30}$ V. O. S., with the proper correction. An interesting feature about these cases is that they are both able to read ordinary print with the glasses which are used for distance. Dr. Lambert also presented another case of congenital dislocation of the lenses, on which he had done two needlings in the right eye. The lens was in the process of disintegration. There had not been the slightest complication in any of these cases.

Dr. Geo. H. Bell showed a patient 48 years of age who had been operated upon for **traumatic pulsating exophthalmos.** This patient was presented before the section at the meeting held February 18th. Dr. F. W. Murray ligated the right common carotid at the New York Eye and Ear Infirmary on February 26th and the patient was in bed for one month after operation. The bruit has disappeared, the exophthalmos is decidedly less, and Dr. Bell hopes for still further improvement.

Dr. Bell showed a case of **iridocyclitis** which he thought was due to **dental infection.** Patient, age 48, was first seen on March 16, 1918. There was marked ciliary tenderness and injection, and the anterior chamber was nearly filled with blood. Through this blood could be seen a contracted pupil and an exudate in the pupil. Tension was slightly minus. The eye looked so suspicious of a foreign body that an X-ray was ordered, which proved to be negative. Wassermann was negative. On examining his mouth, Dr. Bell found that he had two loose teeth and severe pyorrhea. One tooth was extracted at once in the clinic, and the patient was referred to a dental clinic. His vision when first seen was hand movements at three or four inches. The patient was ordered into the New York Eye and Ear Infirmary where he got hot bathing and atropin treatment in addition to having his dental foci cleared up. One month later, tension normal, pupil dilated, blood and exudate all absorbed, and patient now has vision of $\frac{20}{50}$. This patient had no internal treatment.

Dr. Bruder said that he had not seen a case of iritis which he considered due to trouble with the teeth. This patient has a history of inflammation of his joints of eight months' duration. He thinks there may be some cause other than infection from the teeth in Dr. Bell's case.

Dr. Crigler said that he had treated a patient who had suffered from iritis and secondary glaucoma throughout one year. He had been treated by different methods, including iridectomy, without relief until his teeth were all extracted. There was immediate improvement in the eye condition. The inflammation subsided and there has been no relapse.

Dr. Lambert had the impression that tooth infection was now well recognized as a cause of iritis.

Dr. Tenner thought that there might be a latent gonorrhea in this case. In his experience gonorrhea has occasioned more iritis than syphilis.

Dr. Steinbugler in a study of fifty-three cases found that a high percentage of iritis cases were due to tooth infection. Good results were obtained from vaccines.

Dr. BELL said in reference to this eye condition being due to rheumatism as one of the members present had suggested, he thought that all agreed that rheumatism was due to either the teeth or tonsils, and as this man had no tonsils, we would naturally think of a mouth infection in case of rheumatism. Sir W. Lang, who has gone into the etiology of two hundred cases of iritis in his practice, gives 6% of them due to syphilis; tuberculosis 11%; general affection 8.5%; other causes 25%; and pyorrhea 37% and gonorrhea 11%. In seventy-four of two hundred cases, the iritis was due to defective teeth and stumps. In this patient of his, the improvement was so great with clearing up of his mouth infection that Dr. Bell is forced to conclude that the iridocyclitis was due to oral sepsis. The patient's eye was in such a state of inflammation when first seen that it looked exactly like an eye with a foreign body in the globe, and treatment of his teeth was only a routine matter, which is done in Dr. Bell's clinic in all interesting or obscure cases.

Dr. MARK J. SCHOENBERG presented a case of **paralysis of associated movements** in a patient with syphilis. The patient, 40 years old, seamstress, American born, was infected with lues at the age of 18 years. She began to suffer from accommodative asthenopia and diplopia 8 years after the infection. At the age of 34 she was compelled to wear bifocal lenses, although myopic. When she first came to the Herman Knapp Memorial Eye Hospital the diagnosis was made of paralysis of associated movements upwards and to the left, insufficiency of convergence, and paralysis of accommodation. The neurological and serological examinations revealed several signs of cerebrospinal lues. The localization of the seat of the lesion for these various groups of oculomotor disturbances and the vascular distribution in the oculomotor centers were taken up in detail in the presentation of the case, and the conclusion was reached that the seat of the lesion was in the right anterior corpus quadrigeminum and in the nucleus medialis. Since the condition shows no tendency to progress and no active changes are present in the spinal fluid there is no indication for treatment.

Dr. KAUFMAN SCHLIVEK presented a case of the **retinitis proliferans** type which presented a remarkable ophthalmoscopic appearance. Antonio A., 25 years old, previous history negative except that at the time and for one year before he discovered that the right eye was blind he was working in a mine (possibility of trauma). Seven years ago the patient had a foreign body on the cornea of left eye and when he closed it noticed that he could not see with right eye. Vision in the right eye is fingers at one foot, up and temporally. Cornea, iris, anterior chamber, and tension are normal. The lower nasal quadrant of the nerve head can be seen with the ophthalmoscope and its margin is not sharp. The rest of the nerve head is covered by a mass which is irregularly cone-shaped and extends directly anteriorly to about the center of the globe. This mass is white and fluffy and on it are numerous vessels; some are dark red with no perivasculitis (new formed vessels), others with very marked perivasculitis. Some of these vessels extend backward on this mass to its base and then turn on the retina; some extend from the apex a short distance posteriorly and then swing over to the retina. Where these latter vessels continue on the retina it is decidedly elevated and from these vessels extend directly backward numerous very fine arborescent vessels. At the lower nasal quadrant of the nerve head the vessels are normal. A little above and to the nasal side of the nerve head there is a wide grayish membrane with some new formed vessels on it. This mass is connected with the large one. From the apex of the cone-shaped mass is another smaller grayish nonvascular one which is narrow for a short distance and then suddenly ends anteriorly in a knob. This knob has three extensions: a short narrow one below, one nasally, and one above. The latter two spread out into diffuse fibrillated areas and apparently extend over to the ora serrata. There is perivasculitis along several of the retinal vessels. Peripherally especially above and temporally there is chorioretinitis. In the macular region there are pigment changes. The left eye is normal. Wassermann and Noguchi tests are negative. Urine is normal. Blood pressure 90*mm* Hg. X-ray is negative. Transillumination is negative. No tuberculosis. This case corresponds to the descriptions of retinitis proliferans but nowhere is there any mention of this peculiar arrangement of the vessels.

Dr. JOHN M. WHEELER presented an **unusual case of**

persistent hyaloid artery. The patient, a young man 24 years of age, first learned of poor sight in his right eye a few months ago when he was drafted and rejected by an examiner on account of his defective vision. The right eye is highly myopic and yields vision of $\frac{3}{200}$. In the vitreous there is a strand which is attached to the optic nerve head and which has the characteristic appearance of a complete persistent hyaloid artery, without blood. The interesting peculiarity about this anomaly is that although the strand has the characteristic opacity at its anterior end which is usually seen at the posterior pole of the lens, and although the strand is a fixed body, there is no attachment to the lens. The anterior end is probably about 2*mm* behind the lens and there is no apparent opacity on the capsule. Very fine strands can be seen radiating from the anterior end of the persistent hyaloid artery but they cannot be traced far from this body as they are exceedingly delicate. Dr. Wheeler's theory to interpret this condition is that originally this strand existed as an ordinary complete persistent hyaloid artery attached to the posterior capsule of the lens, and that in the development of the high myopia and with the constant lengthening of the globe the strand became detached from the lens but retained fixation in the vitreous by fine threads which may possibly be attached to the zonule and the ciliary body. The left eye is normal.

Dr. William McLean (by invitation) read an interesting paper on "Experimental Studies in Tonometry" (published in this number).

Prof. E. A. Green, Professor of Physics at the Boys' High School of Brooklyn, said that he had examined Dr. McLean's testing apparatus and was satisfied that it works in perfect accord with the simplest principles of hydrostatics. He said there was found an average variation of 15*mm* between the Schiotz tonometer readings and those of the mercurial manometer.

Dr. G. DeWayne Hallett said that because of his conviction that Dr. McLean had devised a scientific instrument which accurately measures in millimeters of mercury the intraocular tension he was glad that there developed in his service three cases appropriate for enucleation upon which these experiments could be made. In all these demonstrations upon the human eye in situ, after Dr. McLean had inserted the canula into the globe, to the steady maintenance of which he gave his entire attention, it was Dr. Hallett's function to apply the footplate of the tonometer accurately to the cornea. An assistant read off the position of the marker on the scale. Another maintained the manometer in a proper position under Dr. Holzapfel's direction, and his guidance was taken from the location of the air bubble in the tube. Another assistant noted the pulsations of the manometer fluid as being synchronous with the heart's action. All this division was for the purpose of avoiding error. The readings were remarkably uniform, and wonderfully confirmed by experiments upon animal eyes, in situ and also enucleated. The excellent features of the instrument are: a longer reading arc, a direct reading scale, the proximity of the scale and the footplate, and the avoidance of weight shifting.

Dr. SCHOENBERG said that it would be interesting to know whether the lowering of intraocular tension which Dr. McLean reports under general anæsthesia is caused by a corresponding reduction of the general blood pressure. Dr. Schoenberg asked if Dr. McLean used cocaine, as this lowers intraocular tension.

Dr. MCLEAN replied that he had not made observations to determine the effect of cocaine on the tension in human eyes. He always uses holocaine as he has known of two cases of acute glaucoma from cocaine instillation. In one case cocaine was given for the removal of a chalazion and acute glaucoma followed.

Dr. LAMBERT asked if there was a constant difference between readings from the Schiotz and McLean tonometers.

Dr. MCLEAN replied that there was found to be a sliding scale of difference ranging from seven to twenty-five.

MONDAY EVENING; OCTOBER 21, 1918. MARTIN COHEN, M.D., CHAIRMAN.

Dr. M. URIBE-TRONCOSO presented a case of **tubercular endovasculitis of the retinal vessels with degeneration of optic nerve and retina.** The patient, 32 years old, a sailor, well built and healthy appearing, who at the end of July, 1918, noticed a blurring of vision in the left eye, rapidly coming to a total blindness in four or five days. Being in France at that time, he was interned in the hospital for one month, his condition being diagnosed as "neuroretinitis" and a treatment of salvarsan and mercury instituted. The patient came back to this country in the middle of September and when first seen gave a history of chancroid two months before the beginning of the eye trouble. No other diseases were reported, his general health having always been good. On examination the left eye was found to be entirely blind. Externally there was only a slight pericorneal injection. The dilated iris was attached to the capsule of the lens by numerous synechiæ, mostly thread-like, and the rim of the iris adherent to a great extent, in the upper part of the pupil, by a whitish exudation. Media clear. Optic nerve hazy, covered by a white veil, with blurred margins and surrounded by a white narrow ring. Its level was slightly depressed, about one diopter.

A striking feature was the total absence of the arteries and veins upon the disk. On the borders some of the larger vessels could be detected; the lower temporal artery as a whitish cord and the upper temporal and lower nasal as strings of white glistening patches of a beaded appearance. In some places it was easy to detect between the patches, and also in the extreme periphery, the vessels transformed into white cords. Upon the disk, in the inner and upper part, small newly formed vessels radiate from the center like a fan. Around the papilla a complete ring of white glistening patches, linear or round, closely resembling the appearance and arrangement of a retinitis circinata, but encircling the papilla instead of the macula, could be detected. They were separated from the disk by a zone of a dark red color, in which small round hemorrhages were visible. The macular region, and in fact the whole eye ground, was covered with white round glistening spots about the size of a pin head and larger, generally arranged in groups. The choroid is normal, and no pigment is visible elsewhere.

Careful systemic examination detected a mitral lesion, but no other disease could be made out. Wassermann was negative twice in the blood, and also in the spinal fluid. Urine was normal. In view of these negative findings an injection of 1*mg* old tuberculin was made and after twelve hours a weak positive reaction was obtained. A new injection of 3*mg* and another of 5*mg* gave very slight general reactions, but elicited a local reaction in the eye in the form of a hemorrhage in the upper and outer part of the disk. This hemorrhage invaded the vitreous and was surrounded by a hazy zone. A last injection of 10*mg* tuberculin produced a rise in temperature of one degree, and an enlargement of the hemorrhage into the vitreous, new vessels developing afterwards in the vicinity.

The interest of this case lies in the total occlusion of the retinal vessels and the degeneration of the nerve and retina. The author first thought of a gumma or tubercle of the optic nerve, but the vascular conditions looked so preëminent as to be considered the primary cause. The complete endovasculitis was probably induced by the sudden discharge into the blood of the central artery of a great number of tubercle bacilli, which produced septic emboli. This accounts for the rapid loss of sight. Then the nerve became inflamed and an exudate developed around the papilla. That there was not a sudden stopping of the circulation in the central artery is proved by the normal color of the fundus, the lack of the cherry red spot or its sequelæ, and the report of the French surgeon. Another interesting feature of this case is the formation of the ring of white spots around the disk, on the macula, and in the periphery of the eye ground. That they are related to the endovasculitis obliterans and not to the toxæmia seems to be a pretty certain conclusion, especially if we bring together the findings in this case with those of Dr. Cohen's case of Kroenlein operation for tumor of the optic nerve, presented at this meeting. He saw Dr. Cohen's case before the operation and only found in the left eye a secondary optic atrophy without any involvement of the retina and choroid. After the removal of the growth, the optic nerve and the short posterior ciliary arteries having been severed, the eye ground presented a very remarkable picture: in the vicinity of the semiemptied retinal arteries, and closely following their course, a great number of white, glistening round and elongated spots could be seen, sometimes isolated, sometimes coalescing in large patches with festooned margins. These white spots had the same characteristic features of those observed in the case of endovasculitis, and also resembled closely those found in albuminuric retinitis and retinitis circinata. As it is certain that in the case of Kroenlein operation there was not any general infection or toxæmia to account for the degeneration of the retina, the white spots starting right after the stopping of the circulation in the retinal vessels, it seems rather fair to ascribe them to the vascular disturbance with exclusion of any inflammatory condition whatsoever; the deficiency in the blood supply producing in the very sensitive retinal tissue a granular or fatty degeneration.

Dr. George H. Bell presented two cases of **nodular keratitis,** in a woman, age 50, and in her daughter, age 16. The woman complained of progressive deterioration of sight without pain or inflammation. The woman seemed to be in good health. The girl did not complain at all. The woman had V. O. D. $\frac{20}{50}$, V. O. S. $\frac{20}{70}$, with correction $\frac{20}{40}$. The girl V. O. D. $\frac{20}{30}$, V. O. S. $\frac{20}{30}$. This is a family degeneration of the cornea, and Fuchs considers the affection to be of the nature of a dystrophy, to be recognized by the deposition of substances insoluble in the tissue juices.

The rare corneal affection, which has characteristics similar to those of punctate keratitis, manifests itself in the formation of numerous small corneal opacities, the largest of which usually occupy the central portion. When examined with the loupe, the opacities are seen to be composed of numerous minute rounded or irregularly formed grayish spots located in the superficial layers of the cornea. (Some of the spots in my cases are deeply situated.) In the woman, rather large irregular patches appear at the pupillary area which result from a coalescence of small opacities. Between the opacities the cornea appears dull and hazy, and over the affected site the epithelial layer is somewhat elevated; the peripheral portion is generally not involved. Opacity occurs in both eyes simultaneously. It is a slow and chronic disease and starts early in life. Collins and Mayou state that hyaline material has been found in these patches. The little girl has the "*lattice-shaped variety.*" There is present, together with the spots, a network of minute lines in the cornea. Slight inflammatory symptoms make their appearance now and then, while the spots themselves very gradually increase. There is no anæsthesia of the cornea in either case. The Wassermann is negative in both cases.

Etiology is very obscure, but I think it is due to some form of toxæmia. Fuchs recently reported two cases he had, one in a man, age 50, and the other patient was a man, age 29. Fuchs operated upon both of these subjects. One was improved and one was not. Of course, in my cases, no operation is indicated or advised.

Dr. GUTTMANN said that Dr. Bell's cases were of interest on account of the fact that the disease attacked two members of the same family.

Dr. DAVIS referred to a case in a man 43 years of age. He said that the disease developed at the age of 25. There were numerous punctate spots situated in the center of the cornea in a perfect circular arrangement 4*mm* in diameter. The cornea was not anæsthetic. He said that the cause of such a condition is still unknown.

Dr. GEO. H. BELL presented a boy, age 14, with a piece of "gold" in the lens. Vision began to fail two weeks before he went to the New York Eye and Ear Infirmary. V. O. D., hand movements, V. O. S., $\frac{20}{20}$. No pain; no redness. At about 7 o'clock on cornea you can see scar where foreign body entered; on dilating pupil you can see foreign body in lens which has a gold luster. You can even see the yellow color in the daylight. He was working on a foot-press with gold metal and a chip flew off and struck him in the eye. This gold he was using for making rings. Patient did not experience any pain at the time of accident. There must have been some alloy in the gold as the patient now has a siderosis. He has never had any tension, and no inflammation. Dr. Bell expects to remove the piece of gold as well as the cataract next week. He was not able to get the patient's consent to the operation until the siderosis appeared, which was quite recently.

Dr. L. W. CRIGLER presented two cases of **trachoma with corneal involvement relieved by Heisrath-Kuhnt operation.** The first case was that of a woman 47 years of age who developed trachoma in the left eye ten years ago. After three years' duration, in spite of medicinal treatment, pannus developed in the upper quadrant of the cornea, and transformation from ulceration to cicatrization was steadily going on in the conjunctiva of the upper lid. This eye was operated upon seven years ago. Within a few weeks after the operation the pannus disappeared and all inflammatory symptoms subsided. There has been no recurrence of the pannus since and the patient's vision has materially improved. About two years ago the patient noted trouble developing in her right eye. In view of the fact that it was inconvenient for her to visit the hospital, she has been treated at another institution, but noting the eye getting steadily worse she returned to the Manhattan Eye, Ear, and Throat Hospital saying that she would like the same treatment for the right eye as was given the left seven years previously. This eye was operated on a month ago and the blood-vessels in the cornea which could be seen extending almost to the pupillary border have almost entirely disappeared and with them the other inflammatory symptoms.

The second case was that of a young man who was operated on two years ago. His vision was reduced to light perception and the entire cornea was infiltrated in each eye. This young man states that he was carried before a class of students by one of our prominent ophthalmologists in another institution who stated that his vision would never improve. The patient now has $\frac{20}{200}$ vision in the right eye and $\frac{20}{100}$ in the left. The pannus has entirely disappeared but there is a permanent slight opacification. Every symptom of his trachoma has been relieved, and all treatment has been stopped. For six months after the operation he was kept under observation and treatment which consisted of mild astringents and dionin.

Dr. KNAPP said that the important feature of any operation is its late result. In this connection it may be interesting to note that Kuhnt's successor in Königsberg does not do the "combined excision" operation.

Dr. DAVIS condemned the operation as being wrong in principle and said that he thought that such an operation should never be done. He said that he had seen a case recently in a young boy in which there was some interference in motility when the patient looked downward.

Dr. WOOTTON said that he could not see why there should be any aversion to the operation in view of the satisfactory results obtained and reported. He said that the main criticism which some expressed was due to faulty technique of the operator and should not be counted against it. Dr. Wootton said that he and his associates at the Manhattan Eye, Ear, and Throat Hospital had operated on about two hundred of these cases during the past eight years and that the results have been so uniformly satisfactory as to convince the most skeptical.

Dr. COHEN said that so strongly was he convinced of the efficacy of the treatment that he did not wait for the formation of pannus or even the cicatricial stage of the disease before recommending the operation.

Dr. CRIGLER said that he was not quite so radical. He waits until there are evidences of beginning corneal involvement. He said that it was to be expected that if the operation is put off until the cartilage and conjunctiva have reached the degenerative stage, little good will come from any operation.

Dr. MARTIN COHEN presented a case of **striated keratitis.** A. H., age 35, married; has two children, both in excellent health. Wife has had three spontaneous miscarriages; one occurred after the birth of the first child, and two after the birth of the second child. The family history and previous diseases are of negative clinical value. General physical condition normal. Wassermann reaction positive.

The patient was first examined at the Manhattan Eye, Ear, and Throat Hospital three weeks ago. He then complained of disturbance of vision in the right eye, with photophobia, lacrymation, and slight pain. Vision was $\frac{20}{50}$ with no correction. Tension was normal. Pupil, circular, central, and reacted sluggishly to light. The aqueous was slightly turbid. Circumcorneal injection was marked. The upper and inner quadrant of the cornea was transparent; the lower and outer quadrant cloudy. This latter area, when examined with focal illumination and the stereoscope, consisted of nine grayish parallel striæ from 3-6*mm* in length and ½*mm* in width; the striæ radiating toward the center. The cornea is transparent between the striæ which space is 1*mm* in width. The striæ first appear about 1½*mm* from the corneal limbus. On a plane with the striæ two discrete linear exudates are readily seen.

Diagnosis: Striated keratitis, due to acute iridocyclitis. When the striæ are examined with transmitted light, using a 11 D. lens, one receives a diffuse reddish fundus reflex; the striæ are apparently fewer and are divisible into two thin grayish lines with a light reddish area between them. One also recognizes in this area several horizontal striæ. The exudates are opaque.

In this case we are probably not dealing with a deep cellular infiltration, as is present in interstitial keratitis, but rather with a refractive condition of the cornea due to wrinklings in Descemet's membrane as described by Hess and Schirmer in similar cases and in experiments. These wrinklings are produced by a diffusion of abnormal fluid through the diseased endothelium into the deep parenchyma. This disturbs the tissue tension of the cornea and causes the development of the wrinkling. When the abnormal fluid is absorbed, the wrinkles disappear. The anatomical arrangement of the normal lymph spaces of the cornea and the appearance of the striæ as in this case preclude dilated clefts or lymph spaces being the cause of the striæ. In striated opacity of the cornea, as occurs after cataract operation, the striæ are located in the upper quadrant and run vertically from the corneal section; this condition is non-inflammatory, of a few days' duration, and is due to wrinkling in Descemet's membrane, as proved by various observers. Fuchs uses the term "striated opacity" in non-inflammatory conditions, while striated keratitis is applied to cases due to an inflammatory disease.

Treatment: Hot local applications, and the use of atropine three times a day. General treatment, anti-luetic. The condition is slowly improving.

Dr. COHEN presented a case of **tuberculosis of the conjunctiva**. Boy, age 8½, has never been seriously ill; family history negative. Physical examination—including X-ray examination of the lungs, differential blood count, and blood Wassermann reaction—normal. General tuberculin reaction was positive; however, numerous conjunctival smears were negative for tubercle bacilli or other specific organisms. Cultures were also negative for sporotrichon. Conjunctival scrapings inoculated into the anterior chamber of a rabbit, after two weeks, gave a negative result. The rhinological examination was negative.

The present eye condition, which is of ten weeks' duration, is solely localized to the left lower tarsal conjunctiva. The lid is decidedly thickened, and when everted (which is difficult) we perceive the conjunctival surface to be uneven, which is due to numerous isolated raised papules about the size of the head of a pin; the spaces between the papules show necrotic tissue. Scattered over the same area are yellowish nodules simulating tuberculous nodules, varying in size from the head of a pin to a pin point. Some nodules are gradually invading the mucocutaneous border of the lid. The entire tarsal conjunctiva is frequently covered by a purulent exudate which when removed causes bleeding. The pre-auricular, cervical, and submaxillary glands are markedly enlarged solely on the side of the lesion. No other glandular enlargements.

The diagnosis was established by the clinical findings, the general tuberculin reaction, and the exclusion of conditions which simulate it. The disease is probably exogenous. The treatment consisted of frequent local irrigations with saturated boric acid solution, local applications of 1% silver nitrate, and general hygienic regulation with therapeutic tuberculin injections. Too short a time has elapsed to report any final results.

Dr. COHEN also presented a case of **tumor of the optic nerve (myxoglioma)** which is published in full in the ARCHIVES with photomicrographs.

Dr. ARNOLD KNAPP presented **two specimens of intraocular disease with anterior scleral ectasia.** Inflammatory conditions of the eyeball in which ectasias in the anterior part of the sclera develop are always serious, and as the diagnosis is not clear, the report of the two following cases in which this complication occurred may be of interest.

The first is that of a colored woman, J. T., aged 48, who came to the hospital in September, '17, stating that her eye had been inflamed for three months. The eye presented the symptoms of a severe iridochoroiditis with marked ciliary congestion, exudate in the pupillary space, and the formation of new vessels in the iris structure. Vision reduced to perception of light; no details could be observed in the fundus. The usual treatment brought about no particular improvement. The tests which were made were not positive. One month later she returned with a marked swelling of the sclera in the outer part. Tension was increased, inflammatory symptoms more pronounced, and the eye was painful. She consented to enucleation and on sectioning the eyeball the condition which the specimen presents was found present. The microscopic examination revealed a tuberculous process.

The second case is that of a young man, aged 23, who was admitted to the army last fall with normal eyes. About three months later the sight in the left eye failed. Subsequent discharge with diagnosis of detachment of the retina from unknown cause. About a week before, May 23, '18, the eye became inflamed and painful. On examination there is a well-marked ciliary congestion and a pronounced scleral nodule at about the site of the internal rectus insertion. The anterior chamber is shallow, iris markings fair; oblique illumination shows a reddish mass in the nasal side of the eye ground covered with a small hemorrhage. Perception of light present. The Wassermann test proved negative, even after provocative salvarsan. The tuberculin test gave a marked arm reaction and fever, but no particular change in the eye. On June 8th the eye is enucleated and on opening the eyeball a well-marked sarcoma of the choroid is found present which has extended by perforating and thinning the sclera at the site corresponding to the internal rectus insertion. Slightly posterior there is another point in which the scleral tissues seem to have been traversed by the tumor process.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

BY MR. H. DICKINSON, London.

An ordinary meeting of the Section was held on November 6th, the new President, Mr. W. T. Holmes Spicer, F.R.C.S., occupying the chair.

PRESIDENT'S ADDRESS.

The President, after thanking the Section warmly for the honor accorded to him, proceeded to deliver an address, illustrated by many sketches, on **the causes of some of the appearances of the cornea after inflammation.**

After ophthalmia neonatorum, but little was sometimes to be seen except vascular channels, yet the stagnation of the lymph circulation might bring about slowly advancing changes long after the subsidence of all inflammatory appearances. Nettleship had described linear paths of clear corneal tissue in large diffuse lipomata, these latter having, probably, arisen after small spots in infancy. And Fuchs discussed the various linear formations existing in the cornea, suggesting that the lines were due to changes in the lymph system. In one of Sydney Stephenson's cases, the lines traversed a nebula with opacity, and there had been repeated attacks of corneal inflammation early in life. Story recorded lines of this character in interstitial keratitis, and he thought they were due to a clearing of the vessels. The picture presented varied according to the depth of the vessels concerned. It was uncommon for vessels to disappear and leave no trace: even though empty of blood, they could be seen as silky threads on the surface, or as clear lines beneath the surface. The vessels in one layer of the cornea did not interfuse with those in another layer. The first necessity in the production of these conditions was a destruction of tissue. The contraction which followed that either interfered with nutrition, or interrupted the flow of lymph, leading to stagnation and the deposition of salts. Arcus senilis was more likely to occur in eyes which have had corneal ulceration.

Mr. Treacher Collins proposed and Mr. Lang seconded a cordial vote of thanks to the President for his address.

CASE.

Mr. Harley Goldsmith exhibited and demonstrated a case of **excessive dilatation of retinal veins and arteries** in one eye. When examined for admission into the Army a few weeks before, the examining surgeon said the vision of the affected eye was better than that of its fellow. The upper temporal vein was enormously congested, and the corresponding artery much dilated.

PAPER.

A paper was contributed to the Section by Dr. J. B. Christopherson and Major R. C. Archibald, of Khartoum, on **a case of primary nocardiasis of the lacrymal gland,** caused by a species of nocardia hitherto undescribed.

The authors said the lacrymal gland appeared to be one of the most remarkable glands of the body. Having but few disorders of its own, it fulfilled its destiny undisturbed by the disorders of the outside world, content to be left alone to administer its secretion to the great master-tissue the eye. The causal agent in the case here recorded was a germ or fungus which grew readily aerobically and produced arthrospores.

The patient, a male aged 22 years, was admitted to hospital suffering from a swelling of the right eye, and inability to open it. The duration of the case had been three and one half years. Neither scar nor wound was to be seen. The eyelids could not be everted, and when raised, a thick yellow discharge poured out, and the whole conjunctival surface of the upper lid appeared to be rough and granular with deeper ulceration in parts. The swelling was painless and of a doughy consistency, though without œdema. There was a bulging forwards of the fornix of the conjunctiva. No lymphatic glands were enlarged, and the sight was unaffected. The eyeball itself was not invaded, nor were its movements involved. Neither photophobia nor lacrymation was present. Under chloroform, the growth was dissected away. It appeared to have commenced in the lacrymal gland, and to have spread into the upper lid, invading the tarsal cartilage. It extended also somewhat between the eyeball and the bony orbit along the ducts to the lacrymal gland.

Sections showed the morbid histology commonly associated with a fungal infection. A portion of a grain flattened between a slide and cover-glass showed that it was composed of the typical nocardial bacilliform hyphæ, with rounded bodies or spores, the whole being held together in a dense matrix. The paper described the reactions in various media, and gave an account of the mycology. So far as experimentation had gone, it did not seem to be pathogenic to the gray monkey.

Lieut.-Col. R. H. ELLIOT commented on the rarity of actinomycosis in Madras, especially in Madura where the disease generally was extremely common.

Mr. LESLIE PATON expressed the gratitude felt by the Section for the paper, for the specimens, and the precautions taken by the authors to ensure its safe arrival.

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ARCHIVES OF OPHTHALMOLOGY.

PLASTIC SURGERY OF THE EYELIDS AFTER WAR INJURIES.

BY T. HARRISON BUTLER, M.D., OF BIRMINGHAM (ENGLAND).

(*With six illustrations on Text-Plate IV.*)

BEFORE the war injuries of the lids calling for extensive plastic surgery were not common, and few ophthalmic surgeons obtained sufficient material to become really proficient in this branch of the art. The war has altered this state of affairs, and great progress has been made; old methods have been perfected and new ones have been called into being. For the past three years the top story at the Birmingham Eye Hospital has been allotted to wounded soldiers, a large number of plastic operations have been performed; and considerable experience has been gained. Cases are now operated upon with more certain knowledge of the correct procedure to adopt and of the detailed technique necessary to obtain a successful result than was possible earlier in the war. At that time there was a decided lack of boldness, and sometimes the choice of a method inadequate in its scope led to partial failure, followed by a second operation, whereas a more drastic attack would have given immediate success. As an example: a soldier in which a lower lid was slightly drawn down by scar tissue was operated upon by a V Y, or Wharton Jones, procedure. The result was only partial and the scarring more extensive than in another exactly similar deformity treated by turning down a pedunculated flap from the temple.

The cases fall naturally under two heads: deformities and malposition of the lids caused by wounds and by contracting scar tissue; and actual loss, partial or complete, of one or both lids. The operations which we employ to remedy these defects are of three types: the use of pedunculated flaps; V Y and sliding operations; and finally grafting. In the large majority of war injuries we now always use a pedunculated flap, but when the deformity has been produced by burns a flap cannot always be obtained, and then we fall back upon grafting. The degree of success gained is largely influenced by the state of the lid edges. Given an uninjured margin a satisfactory lid should be obtained by a well planned attack, but if the lid margin be absent or seriously damaged, then the final result is apt to be imperfect.

The object of these plastic operations is generally a cosmetic one, to remove deformity with the minimum scarring, and to enable an artificial eye to be comfortably worn. It is often impossible to achieve success in one operation; often several are necessary, and both surgeon and patient need much patience before the defect yields to a course of treatment in which each intervention is designed to lead to the final adjustment. When large portions of the lids have disappeared and much fibrous tissue has to be cut away the new lid must be built up by successive stages, but with practice more can be done at each sitting, and fewer operations are necessary. The V Y method has proved unsuitable except in the most trivial cases. Although apparently less severe than the flap method yet actually in practice it leaves more visible cicatrices, and generally fails to cure the malposition of the eyelid. We now rarely choose this operation, which is often called the Wharton Jones method. The Wolfe or whole-skin graft is sometimes very successful but it is uncertain, and has we think been largely superseded by the new Esser epithelial outlay plan which we shall describe later.

Pedunculated flaps, generally cut from the cheek or the temple, have given uniformly good results, and we now employ them in preference to any other method whenever the conditions are favorable. We have found that even apparently trivial displacements of the lids are more satisfactorily treated by flaps than by procedures which seem to be less formidable. In all but the slightest deformities a pedunculated flap will

No. 1.—A photograph showing the result obtained by Kuhnt's modification of the V Y operation. As the result of a shrapnel wound a large portion of the malar bone had been carried away, leaving a depressed scar to which the lower lid was adherent. The lid was drawn down nearly an inch below its normal position. The cavity was filled with fat in which a certain amount of suppuration took place, with the result that the initial operation was a partial failure. A pedunculated flap turned down from the temple completed the cure.

Nos. 2 and 3.—These photographs show the result obtained by transplanting half of the left eyebrow onto the right side. The right upper lid was drawn up and has been replaced by the use of a pedunculated flap from the temple. The lower lid, which was drawn down, has been replaced by the use of an Esser graft. The depression and the thickened edges alluded to in the text are well shown. The second photograph was taken three weeks after the brow operation.

No. 4.—As the result of shrapnel injuries this soldier had lost the inner half of his right eyelid. It was replaced by a pedunculated flap from the temple which included part of the eyebrow. The hairs were then utilized to form the eyelashes as described in the text.

Nos. 5 and 6.—Two photographs showing the result obtained by successive flap operations, after a course of treatment lasting nine months. The two photographs show the appearance before and after treatment.

ILLUSTRATING DR. BUTLER'S ARTICLE ON "PLASTIC SURGERY OF THE EYELIDS AFTER WAR INJURIES."

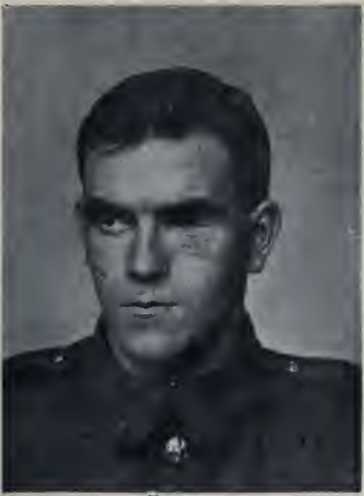
FIG. 1.

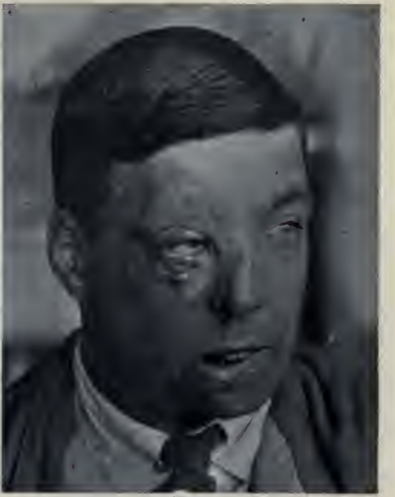
FIG. 2.

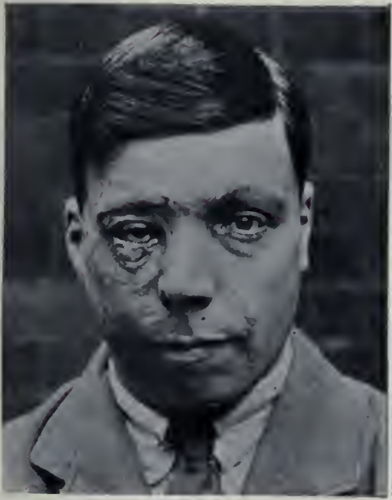
FIG. 3.

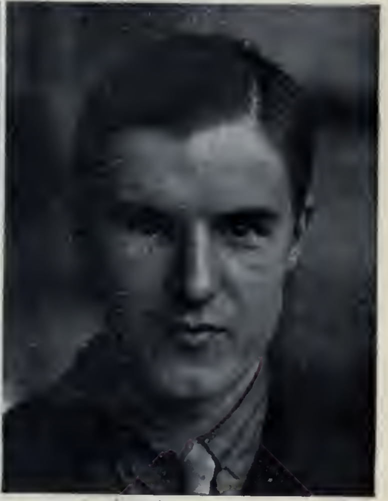
FIG. 4.

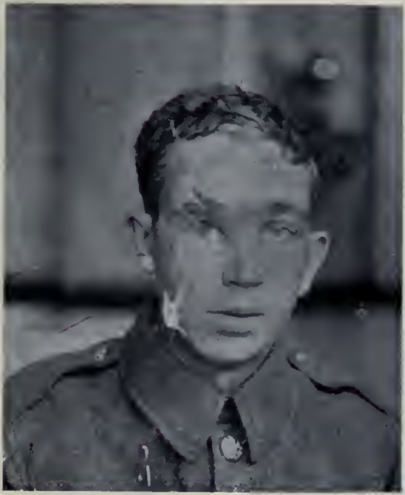
FIG. 5.

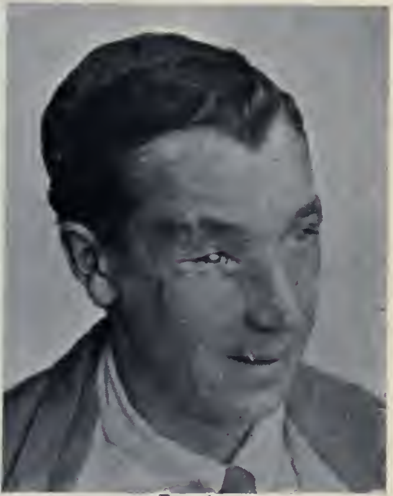
FIG. 6.

remedy the defect with certainty and without leaving unlovely scars. The first essential in all plastic work is to avoid tension, and when this is not possible to reduce it to a minimum, and to transfer the tension to a spot where aseptic healing is more certain than it is at the actual seat of injury. A V Y operation involves considerable tension at the site of the deformity, and close to the lid edges. A little suppuration is more likely to occur here than on the temple; it may vitiate the result and the resulting cicatrix will be bad and in an exposed situation. If some suppuration takes place along the edge of the transplanted flap the final result is not prejudiced. The flap will always be taken from the temple unless local conditions forbid: for example, if, as in our last case, the lower lid be drawn down and a scar run outwards from the external canthus, then an upward flap would have a cicatrix across its base and its blood supply would be quite inadequate. Here we are compelled to take a flap from the cheek. Again if both lids be displaced we cut two flaps, one from the cheek, and the other from the temple. The objection to the cheek flap is that it leaves a scar, which, however, is rarely objectionable. The scar from the temple flap must be kept close to the outer canthus. It then lies in wrinkled skin and soon becomes invisible.

The technique for this operation is quite simple. An incision is made below or above the edge of the displaced lid and all adhesions and bands are freely separated. Often they run deeply into the orbit. The skin is undermined till the lid lies easily in its normal position. The length and width of the defect are now measured with compasses, and a suitable flap marked out. It starts from the outer edge of the wound and extends upwards for the same length as the wound.

The external incision is not carried as low down as the internal, the part left below being as long as the flap is wide. The flap is now dissected up first with scalpel and then with scissors till it rotates freely without any wrinkle at the turn. The base should be separated as little as possible to leave a good blood supply. The end of the flap must be left blunt and the depth of the dissection is just as much as comes naturally. We use catgut sutures. The flap will be found to be firmly healed in place in about a week.

In cases where there is a depressed scar caused by loss of bone, the cavity left when all the redundant fibrous tissue has been cut away can be filled with fat from the buttocks. Originally we inserted the fat when the flap was made, but the fat is liable to suppurate, and we think that it is a better plan to insert it at a subsequent operation. Suppuration in the fat does not imply that it fails in its object; it becomes changed into a fibrous mass which more or less occupies the cavity. As a matter of fact a simple flap operation rarely if ever suppurates but practically always unites by first intention. When the deformity is situated at the inner aspect of the lids, for example the large defect left by the incision of a rodent ulcer, flaps can be cut from the nose and forehead, and it is surprising how soon the scars become almost invisible.

After two years' constant use of the pedunculated flap method we conclude that the operation is easy, that healing is certain, that the cosmetic effect is good, and that there are no obvious disadvantages.

A modification enables us to replace the eyebrow and the eyelashes. In a recent case whose photograph we are able to reproduce the right eyebrow was completely burnt off, leaving a smooth surface of scar tissue. The upper lid was drawn up and the lower lid down, causing complete lagophthalmos. The left eyebrow was thick and bushy. The upper lid was brought down by a pedunculated flap which healed in without any obvious scar or difference in skin texture. The lower lid was brought up by an Esser epithelial outlay which still has a parchment appearance, and is wrinkled at the edges, and somewhat depressed centrally. The patient, a discharged soldier with nephritis, was very pleased with the result, but wished me to make him a new eyebrow. The left brow was shaved and accurately split along its whole extent, and a flap cut a quarter of an inch wide which comprised half the eyebrow. This was cut broader towards the base which was placed over the nose, and the flap was rotated through 90 degrees and placed in a bed prepared for it over the left eye. A mistake was made. The incision was made where the brow should be, but in order to increase the effect of the original graft the skin was undermined only downwards in complete forgetfulness that this process would cause the lower lid to lie too low, as indeed it does.

The effect, however, is excellent. A fortnight later, under local anæsthesia, the base of the flap was excised to remove the hair from above the nose where it was not wanted. This plan can always be employed when there is a good brow to divide. If the brow is not well marked, the operation is not necessary for the absence of the other brow is not so obvious.

Eyelashes present more difficulty, but when the conditions help they can be manufactured from the brow. We show the effect produced in a second photograph.

This soldier had lost the inner half of the original eyelid including the edge. The defect was supplied by a flap from the temple which included the outer tip of the eyebrow. It is obvious that when the flap was placed horizontally in position the strip of brow-bearing skin came to lie vertically. After a month this strip was cut as a secondary flap with its base near the lid margin, and was rotated to lic along the lid edge in such wise that the hairs pointed downwards. It will be seen that the illusion is complete, and, as the eye is a glass one, any distichiasis effect is harmless. The soldier is immensely satisfied with his present appearance, which at a short distance is normal. This process can be utilized in any case with a suitable brow. Part of the brow is split, a flap turned vertically, and later rotated upon its lower extremity till it lies in situ where required.

The Esser epithelial outlay method is still in its infancy; we have only used it during the past six months, but we have had sufficient experience to know that it has immense possibilities in suitable situations, and that it comes to our rescue when other methods are inadmissible. The chief sphere of the operation is undoubtedly in cases of severe burning, when the surrounding skin is parchment-like, and flaps cannot be obtained. We have used it in two such cases, among many others, both epileptics who had fallen into the fire and literally roasted! In one of them the result has been most gratifying from the cosmetic point of view, the other was too badly deformed to admit of much improvement in appearance, but the cure of double lagophthalmos, and the liberation of scars round the mouth have greatly added to the comfort of the sufferer.

We are fully conscious that much more practice and experience is necessary to gain the fullest advantage from this almost epoch-making device.

The advantages are three: the graft invariably "takes," because it is subject to pressure against the surface to which it will adhere, and it is kept warm and moist. Again the method allows of free liberation of the contracted area, and it can be used when older procedures cannot be applied.

The operation seems to have the disadvantage that the cosmetic effect is mediocre; the graft has a wrinkled parchment-like appearance, and some depression remains. Again the edges are apt to be hard and obvious and call for subsequent excision. This is well shown in photograph No. 1. This graft could be improved, but the man had already had three or four operations, and as he was frequently in bed with a rise of temperature, and had casts and albumin in his urine, it has so far been left as it is.

The Esser operation is carried out as follows:

An incision is made along the lid edge in the manner already described above. The skin is undermined in such wise that a pouch is formed. A piece of dental "stent" or "dental molding wax" is warmed and molded till it fits into the pouch easily. An epithelial skin graft is now sewn round the stent, which is put into the pouch, and the edges of the pouch are united with four or five sutures. In from a week to ten days the wound opens spontaneously or is opened, and the stent is removed. The pouch will be found to be lined with epithelium. It gradually unfolds, liberating the contracted lid. The actual details of the operation are important. Dental "stent" is spoiled by boiling but it is still good enough for our purpose. We boil it in an enamel basin and with sterilized fingers mold it to size and lay it down in a sterilized towel placed on a table provided with a chair of suitable height. On the table are placed needles threaded with thin catgut, needle holder, and conjunctival forceps. Molding wax is easier to use, but it cannot be boiled because it melts to a film which floats upon the water. It must be softened in warm water, molded to shape, and sterilized by immersion in an aqueous solution of bioxide of mercury 1:500. An alcoholic solution tends to dissolve the wax.

The graft, which must be about 1¼ inches square, is cut from the flexor surface of the forearm, arm, or from the inner aspect of the thigh. The arm must be flexed or the muscles will stand out and the cut will be too deep. The surface is made flat by the use of two thin boards with well squared edges, each about ¼ inch thick. A sharp razor is employed, a stream of saline being poured over its edge as it cuts. The graft must be thin and should not include any subcutaneous tissue. The graft is now laid on the sterilized towel and spread out with the raw surface downwards. The stent is placed on it and the graft sewn round it with fine catgut. The conjunctival forceps are convenient for this manipulation. The line of sutures must be placed so that they lie towards the outside when the stent is placed in the pouch.

When the unfolding is complete it may be necessary to excise the edges which sometimes remain hard and raised. It is necessary to make the original incision sufficiently long to allow the pouch to flatten out easily, otherwise a pit will persist, and a second operation will be necessary to unfold it. When the graft has to be placed vertically at the inner canthus a secondary intervention is generally called for to complete the unfolding.

The Esser technique is perfectly easy to acquire, but experience is needed to determine the most suitable shape for the stent. A flat crescent seems best for a mold placed above or below the lids. Stents with a round cross section tend to deep pits with incomplete unfolding. We have described an epithelial "outlay"; an "inlay" is used to place grafts in the conjunctiva to remedy contracted sockets, but this is outside the scope of this paper.

Immediate grafting of burns should be employed to prevent contraction. When the burnt surface has become clean and is covered with healthy granulations an epithelial graft is cut as described above and carefully spread over the raw area. It is now thickly covered with vaseline; then with a piece of oiled silk; and again with vaseline. A dressing is applied *and not touched for from ten days to a fortnight.* When the dressing is removed the graft should have grown, and be almost invisible.

This treatment should be adopted far more often than it is. We have said nothing about the Wolfe or whole-skin graft because the technique is well known. We have generally sewn these grafts in place and covered them with a piece of gold gauze, which is sewn down to the surrounding skin. It is essential to obtain pressure upon the graft to keep it firmly and evenly applied in place. Our results have not been equal to those yielded by the Esser method. Not infrequently the whole-graft sloughs and the operation must be repeated.

Plastic surgery is most fascinating, and the actual manipulations are easy. The sole difficulty lies in the plan, which calls for careful thought; it is in this respect that experience tells. We think that it is a mistake to try to do too much at one sitting. A serious deformity, especially when there is loss of tissue, is frequently best approached by stages. One soldier was in the Eye Hospital for nine months and underwent ten operations. At first the case seemed almost hopeless, but step by step the lids were built up, till eventually an artificial eye could be worn, and he was not ashamed of his appearance. It is shown in photographs 5 and 6.

INJURIES OF THE SUPERIOR OBLIQUE MUSCLE—REPORT OF CASE—TREATMENT.[1]

By ALBERT C. SNELL, M.D., Rochester, N. Y.

(*With four illustrations in the text.*)

FROM a review of the literature, cases of isolated traumatic paralysis and also cases of direct injury to the superior oblique muscle are discovered to be of rare occurrence. Therefore, I trust that a report of a case of direct traumatism to the trochlea of the superior oblique, in which it was completely separated from its bony attachment, will be of interest.

The traumatic cases, in which the superior oblique disturbance was associated with disturbance of other ocular muscles, especially with the oculomotor and the abducens, were found to be more numerous. This latter fact is explained on anatomical grounds for the three nerves supplying these muscles pass together through the superior orbital fissure and the origins of their nuclei are close together. Furthermore, traumatic motor disturbances of ocular muscles are most often associated with injuries to the head where central lesions and also fractures and injuries involving the superior orbital fissure are common. The relative frequency of traumatic involvement of the trochlearis is shown by Müller who has reported forty-nine cases of traumatic ocular palsy. Thirty-four of these were due to blows on the head or to head injury; eighteen of this number involved the trochlearis; and of these only two were direct muscle injuries.

In a search through the literature I have been able to find recorded forty-two cases of isolated traumatic disturbance of the motility of the superior oblique (including the eighteen reported by Müller). It was found difficult to separate the cases into classes which involved only the tendon, or the muscle, or the pulley, as most of them were mixed or not accurately determined. Cases involving these three structures numbered twenty-one. In thirteen of the cases the injury was in the region of the pulley. In one case, that of Greven, the trochlea, was completely torn away. A case in which the trochlea or tendon was injured during an operation on the lacrymal duct is reported by Geisler. In eight cases the injury involved the muscle or tendon. Two cases reported by Quintela followed Luc's method of operating on the frontal sinus. With the exception of these cases caused by operation on the sinuses and the one on the lacrymal duct, the injury to the muscle, tendon, or pulley was due to the entrance of an object between the globe and the bony orbit.

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[1] Read before the Buffalo Ophthalmological Club, December 12, 1918.

Twenty-one of all the reported cases, or fifty (50%) per cent., were due to severe injuries to head or face where the lesion was either at the base or involved the motor center. The lesions in this class were due either to fracture, usually along the course of the nerve, or to pressure caused by hemorrhage or inflammatory exudate, located centrally.

Out of the total forty-two cases, twenty-five made perfect or at least very satisfactory recoveries within a period of fourteen days to eighteen months, without operation. In nine cases operations were performed on the superior rectus muscle; in eight cases recovery was not entirely satisfactory, but no operation was performed.

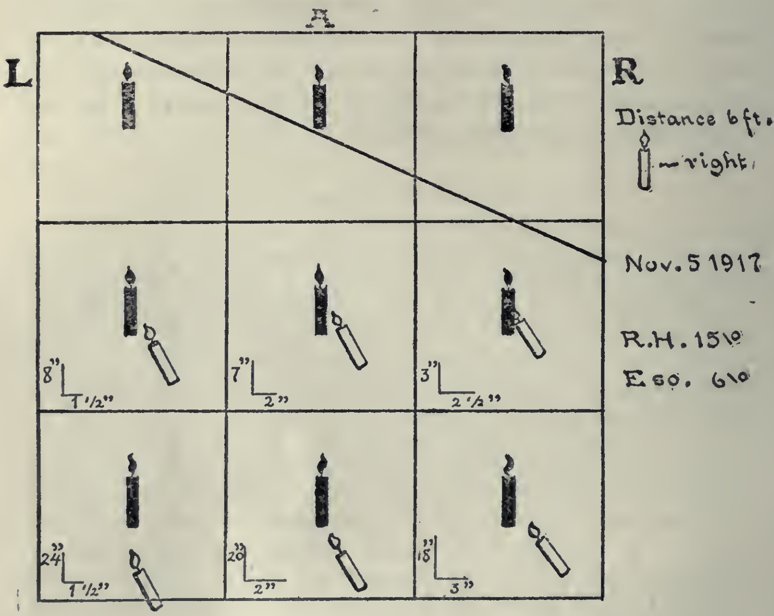
The major part of the cases which made satisfactory recoveries without surgical interference were classed among those having basal or cortical lesions. This demonstrated that the cause of the disturbed function was probably due either to hemorrhage or exudate along the course of the nerve or centrally, and that this promptly absorbed relieving pressure. A small percentage of spontaneous recoveries occurred among those in which the injury involved the muscle or its tendon. In these cases the muscle, or trochlea, or tendon probably was not completely severed, so that injured and bruised tissue became united, at least in part, by the usual inflammatory processes. Compensation of synergistic muscles must also be considered as an important factor in these recoveries. Wertheim, who reports a complete recovery in a case in which both the belly of the superior rectus and the tendon of the superior oblique, posterior to the trochlea, were lacerated by an injury, ascribes the cure to the fact that the superior rectus as an elevator was weakened to the same degree as the superior oblique as a depressor. Consequently, he suggests as a treatment for paralysis of the trochlearis, a tenotomy of the superior rectus. This has been the operation of choice for traumatic disturbance of the superior oblique's function. Uchida suggests an advancement of the inferior rectus for overcoming the diplopia due to paralysis of superior oblique. In my review of the reported cases I did not find any case of traumatic disturbance of the superior oblique in which a tenotomy of the inferior oblique was performed.

REPORT OF CASE.

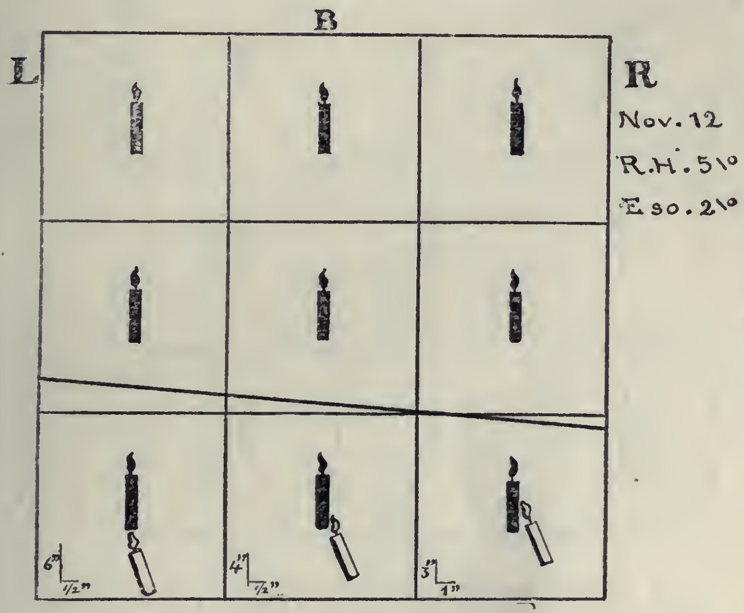
Mr. John Frank, twenty-eight years of age, a skilled mechanic, consulted me on October 2, 1917. At this time he stated that ten days previous he had fallen on an oil can, the spout striking him in the right eye and causing a wound in the upper lid; that since this accident his vision has been considerably disturbed; and that prior to the accident his sight had always been good.

On inspection there were found a scar one fourth of an inch in length, parallel with and slightly below the supraorbital brim, situated at the center of the inner third, a subconjunctival hemorrhage extending from inner edge of the limbus to the canthus, pupils which were active and responded promptly and equally to light stimulus, and vision in each eye of $\frac{20}{20}$. The ophthalmoscopic examination showed all intraocular structures to be perfectly healthy and normal. Patient carried the right side of his head higher with a decided slant or tilt and with face looking toward the right. There was limited movement in O. D. downward. Diplopia was found in the lower field and became most marked when looking down and strongly to the left. Fusion was maintained for all distant objects. In the primary position with tilt corrected, Maddox's red rod test revealed esophoria of four (4°) degrees and right hyperphoria of twelve (12°) degrees. The position of the injury, the fact that his double vision increased on looking down and toward the left, right image being lower, that the eye was in adduction, and that the false image was tilted toward the left, established a diagnosis of motor disturbance of the superior oblique. Charts of the area of double vision were frequently made and these confirmed our diagnosis.

Patient was under observation from October 2d to the 22d, during which time the swelling and ecchymosis disappeared, but the double vision became more annoying. The double vision, which did not incapacitate him during the first two weeks following the accident, became now so extremely annoying that he was unable to follow his usual occupation, that of running a large, complicated machine. The operation required the accurate judging of distances and perfect orientation. He had several narrow escapes from injuring his hands in the moving machinery and finally did receive an accident which compelled him to give up the work.

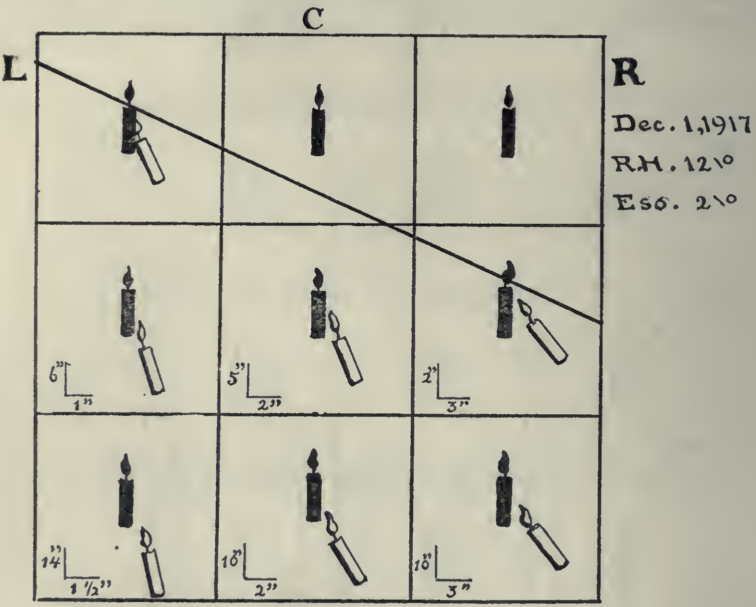


On October 22d, under local anæsthesia, I made an incision near the area of the wound and exposed the superior oblique muscle. I undertook the operation believing that this muscle was probably torn and lacerated to such an extent that it was impossible for nature to reunite the severed parts, and I thought that it might be possible for me to suture them together. The tendon of the muscle and its insertion into the eyeball were easily exposed and the tendon was then drawn forward on a strabismus hook. I found that neither the tendon nor the muscle was injured or severed, the pull of the muscle being decidedly felt when the patient looked down, but the pulley's attachment was completely torn away. I was not able to isolate the pulley or to place the muscle tendon in its proper position. Therefore, in the neighborhood of the trochlea I attempted to gather some tissue by a sort of purse-string method using catgut and tying all together, hoping that the tendon of the muscle might become fastened in some scar tissue and make an artificial trochlea. This of course was an entire failure.

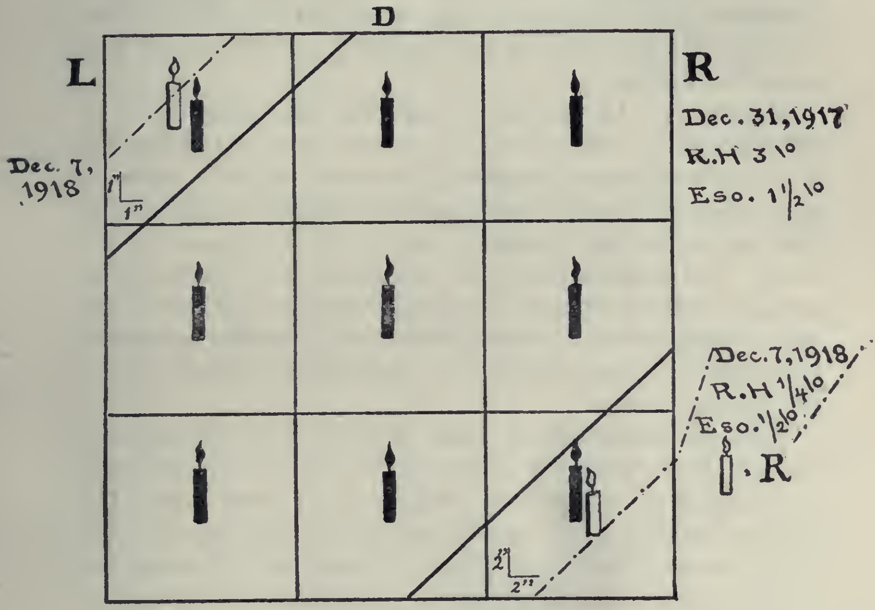


On November 8th, a tenotomy of the right superior rectus was done, cutting the central fibers completely but leaving the peripheral attachments intact and vigorously stretching the cut muscle. For several days following this operation there was considerable improvement in the area of single vision and there was less phoria. On November 12th, four days after the tenotomy of the superior rectus, marked diplopia persisted in the entire lower third of the motor field, but fusion was possible in the upper two thirds and for distant objects. With head straight and level we found two (2°) degrees of esophoria and five right hyperphoria, and in the lower left motor area the vertical displacement was between six and eight inches, candle at six feet distance.

By December 1st we had lost nearly all of this gain, the area and degree of diplopia being only slightly better than that of November 5th, esophoria being three (3°) degrees, right hyperphoria twelve (12°) degrees. The persistent diplopia in the lower field made it impossible for him to return to his work, which fact meant a great loss in his earning ability. The slight gain of fusion in the upper motor area was of no real economic value.



In 1915 I had the pleasure of hearing Dr. Posey's paper which he read before the American Ophthalmological Society on "Tenotomy of the Inferior Oblique Muscle." A further study of his article convinced me that this should be the operation of choice for this case. One of the indications for tenotomy of the inferior oblique was pointed out to be "spasm or over-action of this muscle following paralysis of the superior oblique." In this case there was overaction of the inferior oblique, and the tearing away of the trochlea produced a condition simulating paralysis. Therefore, on December 17, 1917, I performed a tenotomy of the inferior oblique of the same side, following Posey's technique, the muscle being freely and completely divided. The effect was immediate. Motor charts showing the area of double vision were made on December 18, 20, 21, 31, 1917. On all of these occasions areas of double vision were found to exist in the upper left and lower right squares only, single vision being maintained in all other parts of the field. In the left upper area the images were separated one inch both vertically and horizontally and were crossed. The right image was the higher, indicating an overaction of left superior rectus and left inferior oblique. In the right lower area the images were homonymous and were separated both vertically and horizontally two inches, the right image being the lower, indicated an overaction of left superior oblique. The diplopia in these motor areas caused no annoyance since it occurs in those parts of the field which are of least use and importance. Since this operation he has been able to look down in convergence without double vision, so returned to his former job.



At my request he returned for examination on December 7, 1918. He states that he has done his work very satisfactorily and without difficulty during the past year. At this time diplopia is still present but only in the extreme corners of the left upper and right lower motor areas: being similar but involving less area than it did on December 17, 1917. There was no diplopia for distance, but right hyperphoria of one quarter of a degree and esophoria of one half degree.

According to Posey, the credit for first suggesting tenotomy of the inferior oblique muscle belongs to Landolt who suggested it in 1885, but this author apparently never performed the operation. In 1906 Duane again brought to the attention of the profession the indications for this operation which had been performed by him; but it was Posey's article, in 1915, which pointed out its indications and value; and, by reporting the result of the operation on twenty-one cases, brought the subject to the general attention of ophthalmologists. The technique of the operation is fully described in this article and is essentially the same as that followed by Duane and suggested by Landolt.

Treatment: In view of the fact that approximately sixty per cent. of the cases of traumatic disturbance of the superior oblique muscle make a satisfactory recovery within a period of eight months—usually much sooner—prudence would dictate that any operative procedure should not be considered too early. The disturbances of this muscle due to indirect injuries are most likely to recover; but even those due to direct injury where the muscle or its tendon has not been completely severed, have ceased to cause diplopia or annoying symptoms after a few months.

When an operation has been decided upon the choice is between a tenotomy of the superior rectus of the same side and a tenotomy of the inferior oblique of the same side. The former operation has been quite satisfactory according to the reported cases, but when there are symptoms of spasm or of overaction of the inferior oblique of the same side (as in my case) a tenotomy of this muscle is the indicated operation.

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REPORT OF A CARCINOMA OF THE ORBIT.

SPECIMEN PRESENTED AT SECTION ON OPHTHALMOLOGY, NEW YORK ACADEMY OF MEDICINE, NOVEMBER 18, 1918.

By Dr. Arnold Knapp, New York.

(*With four illustrations on Text-Plates V. and VI.*)

Mrs. E. R. W., aged 31, noted in the fall of 1910 a burning sensation in the right eye, with watering. Subsequently the pupil of that eye became somewhat dilated and the sight gradually failed. This was followed by a protrusion of the eye with involvement of some of the ocular muscles. The cheek at the same time became numb. As there was some discharge from the right side of the nose, the nose was operated upon, without any particular effect on the orbital condition. The patient was seen on March 3, 1911, by Dr. F. W. Marlow, of Syracuse, who found anæsthesia of the cornea, marked proptosis 4 or 5*mm*, eyeball fixed, neuroretinitis, and vision $\frac{6}{60}$; along the lower margin of the orbit there was distinct resistance. Dr. Marlow then kindly referred the patient to me for operation.

On October 11, 1911, I found that the right eye was pushed straight forward, and was completely immobile; anæsthesia of the cornea, of the eyelids, and of the cheek. A mass could be felt below and to the outer side of the eyeball. There was no particular change in the eye ground. On October 15th an exploratory Kroenlein operation was done. This showed a diffuse mass invading the periosteum externally and below the eyeball. As the tumor was not circumscribed enough to permit of a radical extirpation with preservation of the eyeball, only a piece of tissue was removed for microscopic examination and the wound closed. This examination showed fibrous tissue with proliferation of endothelial-like cells which was regarded by the pathologist (Dr. James Ewing) as a not particularly malignant process. An exenteration was then determined upon and carried out on November 1st. The contents of the orbit, including

ILLUSTRATING DR. KNAPP'S ARTICLE "REPORT OF A CARCINOMA OF THE ORBIT"

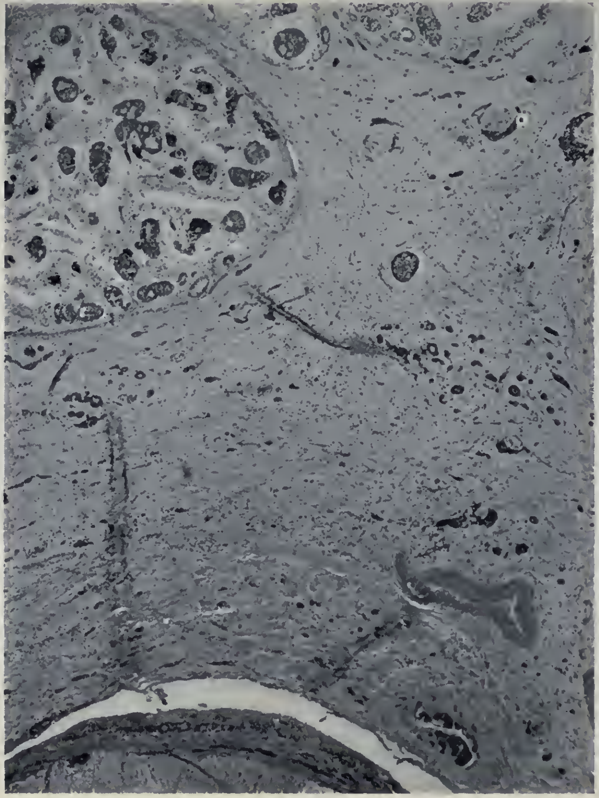

FIG I.
Showing topography of tumor, especially the diffuse fibrosis.

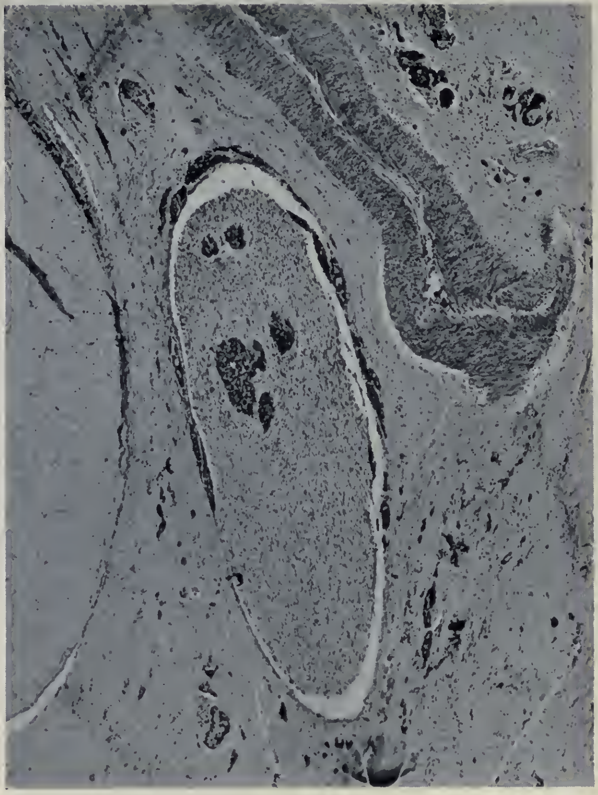

FIG. 2.
Involvement of nerve trunks and optic nerve sheath with epithelial tumor cells.

120

the invaded periosteum and the eyeball, were removed. A mass was encountered at the apex of the orbit which seemed to involve the optic nerve and extended into the ethmoidal cells. This was removed as thoroughly as possible. Healing took place slowly by granulations.

On January 15, 1912, right complete facial paralysis developed, affecting the tongue and the gums; the cheek and the nose were numb.

On May 16, 1912, the right side of the head enlarged, especially the frontal, temporal, and supramaxillary regions, and the patient complained of great pain in the upper jaw. The patient died on December 1, 1912. The vision in her remaining eye, the left eye, had been failing for the last three months and she became quite blind, suffering severe pain at the back of the head. The orbit filled up with a growth. The throat seemed partially paralyzed, making swallowing and the opening of the mouth difficult. The cause of death was a tumor of the brain.

The *microscopic examination* of the orbital mass reveals a diffusely infiltrating connective-tissue transformation of the orbital contents. This connective tissue varies in thickness and in the number of cells. It apparently replaces the normal orbital tissues. There are only a few globules of fat to be seen and the muscles are infiltrated with a disappearance and degeneration of the muscle fibers. The tumor has no particular capsule. A distinct characteristic is the constriction of all the tissues, particularly the blood vessels. No trace of the lacrymal gland can be seen; this is not unusual even in tumors arising from the lacrymal gland. Throughout this extensive connective-tissue stroma masses of epithelial cells can be seen constituting the parenchyma of the tumor. These cell collections are irregularly scattered; in places they form curving structures like fissures in the dense connective tissue, filled with epithelial cells which are small and crowded together. In other places the cells are collected in rounded structures, particularly in the region surrounding the optic nerve, where the other nerves are all involved. The optic nerve is not itself affected, but its sheath shows a particularly distinct infiltration of round, alveolar structures with marginal cells and a distinct lumen. Many of the nerve trunks in this region contain round and oval collections of epithelial cells. The cells vary in outline; they usually have large, rounded, deeply staining nuclei with a well-defined protoplasm. In the rounded collection of cells the margin is composed of cellular protoplasm without distinct capsule.

The interesting clinical features of this tumor are its *malignancy* and the *involvement of the nerves of the orbit* in the extension of the tumor process. The duration of the disease was about two years; death occurred one year after exenteration of the orbit with the symptoms of a brain tumor, undoubtedly a direct extension of the orbital condition. The microscopic examination shows that the tumor extended particularly in the nerve trunks. The early immobility of the eyeball can be more easily explained by the extensive fibrosis and infiltration of the muscles themselves than by the involvement of the nerve trunks. Kuffler[1] observed an orbital tumor where the involvement of the nerves was an early and striking symptom. In his case the initial symptom was a VI. nerve paralysis which was followed in six months by the involvement of the other nerves and of the optic nerve. Six months later exophthalmos developed. At operation the orbit was found filled with tumor masses extending deep in the supraorbital fissure, and the patient subsequently died from brain tumor.

The histological characteristics of the tumor are the *extensive fibrosis* and the *collections of epithelial cells*. The epithelial cells vary in size and shape from being small embryonal cells composed of only nuclei, and larger structures, cubical and cylindrical in alveolar arrangements, approaching the adenoid cystic tumor type. In Professor Ewing's opinion the connective tissue is not necessarily the result of a separate developmental disturbance, particularly as no mucin or cartilage were present, but it represents an ordinary, secondary process comparable to the overgrowth of fibrous tissue in scirrhous cancer and in rodent ulcer. The presence of these two classes of tissues suggests a mixed tumor such as occurs so frequently in the salivary glands. Warthin pointed out in 1901 the similarity which exists between growths of the salivary and of the lacrymal glands. The interpretation of these mixed tumors has changed in recent years and the views on the histogenesis have become definite. The tumors at one time were regarded as endotheliomata and as such they are usually

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[1] "Endotheliom der Orbita," *Heidelberger Bericht*, 1911, p. 275.

ILLUSTRATING DR. KNAPP'S ARTICLE "REPORT OF A CARCINOMA OF THE ORBIT."

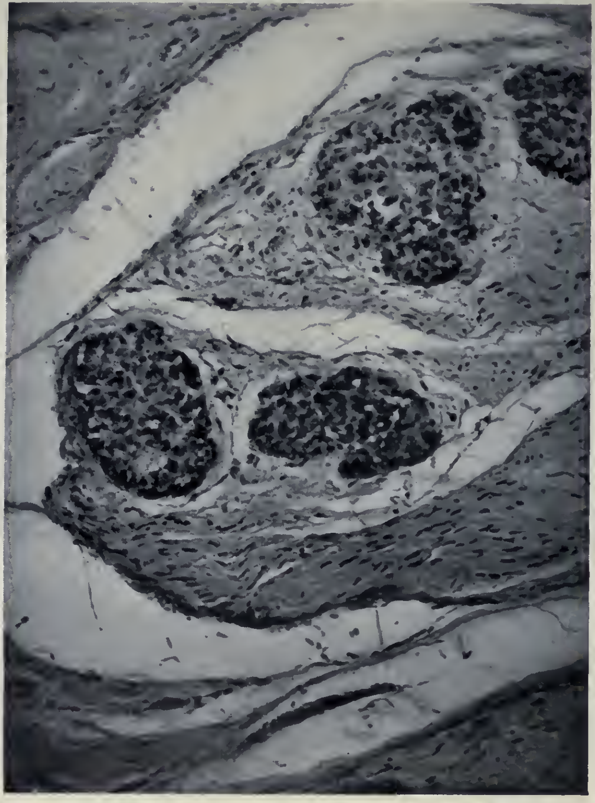

FIG. 3.
Nerve trunk invaded with groups of epithelial cells.

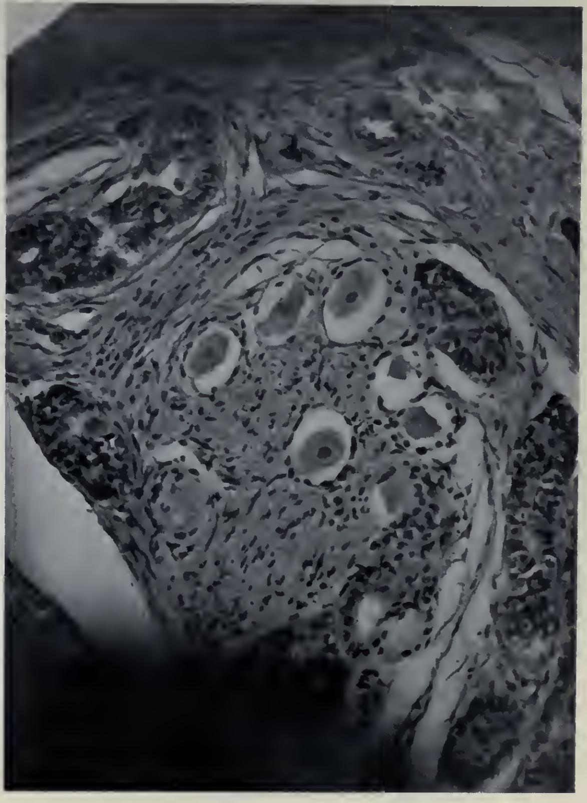

FIG. 4.
Involvement of ciliary ganglion.

reported in ophthalmic literature. Endotheliomata are diagnosticated by the morphology of the cells and their relation to the surrounding structures. Ewing believes that the cells in these tumors show no characteristics which permit their classification as endothelium. It is now the opinion of pathologists that endotheliomata occur only where the presence of epithelium can be excluded.

It is now generally accepted that the parenchymal cells are of epithelial origin and that the epithelium from which this is derived must be that of the lacrymal gland. Verhoeff[1] believes that the parenchyma of these tumors is derived from epithelium, on account of certain characteristics which he has demonstrated by special stains. This view also accords with our knowledge of the embryology of these glands, as the earliest trace of the lacrymal gland is a solid down-growth of epithelium from the conjunctiva. The stroma is an atypical development of mesoplastic cells, according to this author, which normally would have gone to form part of the stroma of the gland itself.

Krompecher,[2] whose classical investigations on the exclusive epithelial origin of these tumors are generally accepted, concludes that these mixed tumors belong in the class of basal-cell carcinoma and especially in the sub-group of adenoid cystic epithelioma. Under certain conditions true connective tissue, and by further metaplasia, cartilage may be derived from the basal epithelium. Krompecher interprets the salivary growths as of purely epithelial origin with peculiar mucoid and cartilaginous metaplasia.

Van Duyze[3] describes as a mixed epithelial tumor of the lacrymal gland a condition which in many ways resembles the tumor described in this paper. This author is convinced of the epithelial origin of the mixed tumors and that they are derived from two embryonal layers, though he does not accept unreservedly Krompecher's belief of the transformation of epithelium into connective tissue.

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[1] "The Mixed Tumors of the Lacrymal and Salivary Glands," *J. M. R.*, xiii., p. 330, 1905.

[2] *Ziegler's Beiträge*, 37, 1905.

[3] "Tumeur mixte epitheliale de la glande lacrymale," *Arch. d'opht.*, Juillet, 1910.

Ewing, in his new work on *Neoplastic Diseases*,[1] summarizes our knowledge of the origin of mixed tumors of the salivary glands as follows: "(1) The endothelial origin has been disproven. (2) No single source of the mixed tumors meets all the requirements. Some are distinctly adenomatous and probably arise from the acini and ducts of the gland in which they are well incorporated. Others are encapsulated or extraglandular and take the form of basal-cell or adenoid cystic epithelioma. These probably arise from misplaced and occasionally embryonal portions of gland tissue. Branchial remnants may possibly be connected with this group. (3) The derivation of mucous tissue and cartilage from gland epithelium has been satisfactorily proven and there is no necessity of including in the originating tissue any cartilaginous structures."

The difficulty has always been to explain the myxomatous tissue and cartilage which is often found in the stroma. Based on embryological studies, it is now believed that these tumors originate from portions of the embryonic lacrymal gland which have lost their connection with the ducts and have remained dormant as indifferent tissue for a length of time, and that the tumors are derived from early invagination of epithelium with the inclusion of mesoplastic tissue.

Alexander Fraser[2] finds that epithelial characteristics of both the pavement and glandular type have been demonstrated in these tumors beyond question. He does not favor the assumption of a mesodermal origin to explain the polymorphism of these tumors, especially the presence of cartilage or bone, and believes that the connective-tissue elements are derived by metaplasia from the epithelial cells.

Aside from these histological characteristics, the pure carcinomas of the salivary glands, according to Ewing, have a further distinguishing clinical trait in their malignancy, and this applies equally to the lacrymal tumors. They usually develop rapidly and while they are at first encapsulated, they soon invade the surrounding tissues. After extirpation prompt recurrence is observed. In advanced cases local and general metastasis occurs. The clinical malignancy of these tumors is pronounced. Sometimes there is a history of a quiescent growth of long standing which eventually becomes active. Finally, the endotheliomatous origin of these tumors was attacked by those who insisted upon their cancerous nature.

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[1] Saunders, p. 717, 1919.

[2] Alexander Fraser, "Mixed Tumors of the Salivary Gland," *S. G. & O.*, July, 1918.

SOME REMARKS ON THE PUPIL IN GLAUCOMA.

By Dr. JOHN DUNN, Richmond, Virginia.

THE report of the cases here commented upon was suggested by the following combination of symptoms observed in a case of simple chronic glaucoma. In a glaucomatous eye which could see light, and in which there was an entire absence of the primary pupillary response to light, the impact of light on the still sentient portions of the retina awakened a consensual response in the pupil of the opposite sound eye. At the same time the convergent pupillary response was present, as were all the pupillary responses consensual with those of the sound eye. So far as I know this combination of pupillary symptoms has not heretofore received comment in ophthalmological writings, and, as I see it, its chief importance lies in the light it seems to shed on the nervous mechanism concerned in the production of the primary pupillary response to light. In considering the damage done to the retinal functions as the result of this increased pressure in glaucoma, we must bear in mind that it is of two essentially different kinds, the direct and the indirect, and the loss of function is accordingly relative or absolute. In simple chronic glaucoma the contraction of the visual field is not altogether and directly the result of a general pressure of the vitreous body against the retinal elements, but in great measure is due to retinal atrophy, the necessary result of cutting off of the retinal circulation by constriction of the retinal arteries as they are bent over the edge of the excavated disk. The circulation through the peripheral twigs will first be interfered with. This is well shown in the case of A. E. (*vide infra*). Finally, however, the time comes when the generally increased intraocular pressure interferes directly with the functions of those portions of the retina which have escaped atrophy. There seems to be clinical evidence that this pressure abolishes the regulative activities of the retinal pigment layer before it destroys the capabilities of response of the retinal ganglion cells. In acute glaucoma the intraocular pressure is a general one. The vitreous body as a whole is forced back against the retina. The attack may be so severe, during its height, as to deprive the eye of vision and yet it may be relieved and the eye show no constriction of its field for white. Following a severe attack of acute glaucoma, there is usually some mechanical paresis of the pupillary fibers, with a resulting characteristic dilatation. This paresis may or may not be of a permanent character. Thus, while acute glaucoma would seem to furnish the ideal conditions for determining whether pressure against the retina does or does not destroy the function of the ganglion cells before it destroys those of the retinal pigment cells, the tendency to coincident weakening of the constrictor pupillæ prevents in most cases our deciding this question. I have been obliged to have recourse to cases of simple chronic glaucoma, primary or secondary, to make the deductions here given, as all of the cases of acute glaucoma which I have seen since this paper was begun have either been too severe or have been seen too late in their history. In reading this paper it must be borne in mind that in no case, save those of the acute type, are we dealing with any paresis or paralysis of the pupillary fibers. It is well known that simple chronic glaucoma may proceed to complete blindness in one eye and yet this eye may show no demonstrable lessening of the depth of the anterior chamber and may retain its pupil equal in size with that of the opposite eye. Until its later stages the demonstrable damage is done to the retina and its blood-vessels. In these respects it differs greatly from the acute type.

The two following pictures, one of acute, the other of simple chronic glaucoma, are presented without complications in the cases of G. H. and L.

G. H., aged 58, had when I first saw her, been suffering for six weeks with acute inflammatory glaucoma of the left eye, which showed a steamy cornea, behind which could be indistinctly seen a partially dilated pupil in a shallow anterior chamber. No pupillary movements could be made out. Fundus invisible. Vision, light perception. Under ether a broad iridectomy was done. At the end of one month, the following ocular conditions obtained. Vision, with correcting glasses, $\frac{18}{60}$. Clear cornea; under palpation normal tension; shallow anterior chamber; transparent lens and vitreous; cupping of disk very slight; indeed, so slight that in the ordinary examination of the eye no comment would have been made upon it. The pupil responded neither to light, nor consensually nor in accommodation. It was absolutely immobile. One month later: Pupil responded directly, consensually, and in accommodation. The anterior chamber was apparently no deeper. In this class of cases, the pupillary dilatation is the result of pressure against the root of the iris and there takes place a mechanical stretching of the sphincter pupillæ. Absence of pupillary responses is a necessary consequence. How long these responses will be absent after the tension of the eyeball has been removed, by operation and otherwise, will depend upon the character of the damage done by the pressure. If the pressure be continued long enough for the iritic substance to degenerate, the pupillary responses are permanently absent.

L., aged 70, whose vision had for a long time been getting bad, had, when he came for consultation, for two or three days been suffering severe pain in his left eye. Examination revealed the following: Tension + 2, cornea clear; anterior chamber not shallower than is normal for many old people; eye absolutely blind; lens and vitreous clear; deep glaucomatous cupping of disk; pupil of same size as that of opposite eye, 1*mm*, does not respond to light directly but responds actively both consensually, and in accommodation. Light thrown upon its fundus does not, however, awaken a consensual reflex in the opposite eye. Upward sclerocorneal trephining was done after subconjunctival injection of novocain solution. One month later: Tension sufficiently near normal for the eye to cause no discomfort. The pear-shaped pupil does not respond to light but responds both consensually and in accommodation.

Such are the two completed pupillary pictures; the one the product of acute inflammatory glaucoma; the other of simple chronic glaucoma. It is not the purpose of this article to discuss further the details of the manner by which the mechanical paralysis of the pupil present in the case of G. H. was brought about, nor to comment upon the varying degrees of pupillary paralysis to be found in different cases of acute inflammatory glaucoma, nor to discuss the prognosis. We wish to confine our attention to the pupillary picture presented in the case of L.

L.'s glaucomatous eye shows a pupil that does not respond to light, but does respond as actively as that of the opposite eye both consensually and in accommodation. The eye is totally blind. We might say that there is nothing unusual in this; that the pupil in a totally blind eye cannot respond to light impulses on the retina; that it cannot originate the consensual reflex, either the direct consensual or the accommodation consensual reflex; that it can, however, show the convergence reflex so long as the power is retained of turning the eye towards the tip of the nose; that it can respond consensually, both directly and in accommodation and in convergence to impulses originating in the sound eye. Before we decide, however, that we have thus explained all there is to know about this pupillary picture, let us examine the case of P., aged 56. Her left eye has been the seat of simple chronic glaucoma for about three years. Both pupils measure about *2mm* in moderate daylight. The pupillary conditions are exactly the same as exist in the case of L., except that light thrown into the eye apparently awakens a consensual reflex in the opposite eye. In this case, moreover, the patient can tell when fingers are passed between the eye and the light. There is apparently abolition of the entire visual field save for a small area in the inferior quadrant. Here then is an eye which preserves light and in which there is no paralysis of the nerve supply to the iris and yet the pupil does not respond to the direct light impulses but responds as actively as that of the other eye both consensually and in convergence, and further, when light falls upon its fundus it apparently awakens a consensual response in the opposite eye. So far as I know this is the first time this exact combination of pupillary symptoms has ever been called attention to. It will be said that naturally the pupil does not respond to light impact upon that portion of the retina which is blind and that the pupil being small its response to light falling upon the still sentient part of the retina could be easily overlooked. To this I can only say the pupil was most carefully and repeatedly watched under a magnifying lens and no response could be detected.

Here then comes the interesting question. Is it possible for there to be no direct pupillary response to light in an eye which is capable of perceiving light and whose pupillary third nerve tract is intact as shown by its normal pupillary response both consensually and in accommodation? In my effort to solve to my satisfaction the problem of the Argyll-Robertson pupil upon purely theoretical considerations, I came to the conclusion that this must be so or that the A.-R. pupil must forever remain a mystery; that activities aroused within the retinal pigment layer following impact of light on the retina must without traveling centralwards along the optic nerve fibers be directly transmitted to the ciliary region and there arouse sensory impressions, which in turn are carried to the ciliary ganglia, in which body efferent motor impulses are aroused, which in turn result in the contraction of the pupil. At the time I expressed these views (ARCHIVES OF OPHTHALMOLOGY, vol. xlvi., No. 3) I was obliged to leave them without pathological confirmation, nor could I conceive of a way by which the activities of the pigment layer could be suppressed without at the same time suppressing the activities of the retinal cells into which they reach out during the periods of retinal response to light impact. I now believe it is a part of the history of many cases of simple chronic glaucoma. In simple chronic glaucoma there comes a time when the intraocular pressure is so great that it obliterates the normal activities of the retinal pigment cells. In some of these cases this takes place before all function in the overlying retinal cells is destroyed. Hence it comes about that the eye is still able to perceive light and yet the light impulses awaken no activity in the pigment cells. We, of course, have only clinical symptoms as proof of this belief. There is no question that in cases of simple chronic glaucoma, at a certain stage in its history the eye may still be able to perceive light and yet, so far as can be demonstrated, there is no direct pupillary response to the light falling upon the retina and this, too, in the face of an active motor nerve supply to the pupil. That light is perceived shows that some of the retinal fibers have escaped destruction. Why then is there no direct pupillary response? Is a larger volume of nerve impulses along the optic nerve fibers required to generate a sufficient activity in the motor nuclei than is required to create a conscious impression in the cells of the occipital cortex? Are the retinal cells which convey impulses centralwards to the third nerve nuclei distinctly different from those which convey the impulses further backwards? If so, does a gradually increasing intraocular pressure destroy the function of the former sooner than it does that of the latter? There is no proof that any of these things are so. It is true that up to a certain degree the more intense the light impulse the more active are both the direct and consensual pupillary responses. It is also true that in a normal eye the pupil responds to very faint illumination of the fundus. It is also probably true that in a healthy eye there is a pupillary response for any degree of illumination which can be perceived.

How far this last statement is true for an eye such as we have under discussion is a question. That the glaucomatous process has not injured the motor control of the iritic movements is shown by the activity of these movements in the consensual and accommodation responses. Could we find among the uncomplicated monocular simple glaucomatous cases one in which there is retention of the light perception with absence of the primary pupillary response and at the same time impact of light on the retina causes a change in the size of the pupil of the other eye, *i. e.*, evokes the consensual reflex in the opposite eye, it would go far to prove our contention in regard to the nervous pathway pursued in the evolution of the primary pupillary reflex. In the case of A. E. (*vide infra*) impact on the fundus of the glaucomatous eye produces an active consensual reflex in the good eye, but only a very faint primary pupillary response in the bad eye, in which, however, the consensual reflex is active when light falls upon the retina of the good eye. This is a step forward in our contention. The case of P. (*vide supra*) apparently furnishes what we are looking for. When light is thrown upon the retina of her glaucomatous eye (the sound eye being excluded absolutely from the light) there is entire absence of the primary pupillary response. When, however, light is allowed to fall upon its retina, the sound eye being open, apparently there is a consensual pupillary reflex produced in the sound eye. This shows that light impulses pass along the optic nerve to the right third nerve nuclei with sufficient force to cross to the left third nerve nuclei and awaken a response in the left pupil, and yet these impulses fail to awaken any response whatever in the pupil of the diseased eye. On the other hand light thrown into the left eye produces an active consensual reflex in the right, *i. e.*, the glaucomatous eye. This is an important observation and there can be deduced from it but one fact, and that is that light passing centralwards along the optic nerve is incapable of producing the primary pupillary reflex.

Some comments upon the activities of the retinal pigment layer are in order here. That the primary light reflex may be produced there must be present active retinal ganglion cells, active pigment layer cells, an active sensory nerve connection between the ciliary region and the ciliary ganglia, a functionating ciliary ganglion and active motor fibers from the ganglion to an active constrictor pupillæ. Destroy the retinal ganglion cells and you do away with the primary light reflex. You do not, however, do away with a certain tonic influence which the existing retinal pigment layer exerts over the activities of the ciliary ganglion, unless at the same time you entirely abolish the retinal vascular supply. The appreciation of this fact allows us to understand why in some blind eyes, with a normal motor nerve supply to the pupil, the pupil is only half dilated, while in others the pupils are widely dilated. In the latter case there is complete abolition of the pigment layer influence. Below are quoted two cases which illustrate this:

> L. H., aged 58 was, ten years before the occasion of his visit to me, shot through the left temple. The bullet went through the left eye, necessitating its removal. Passing across the upper part of the nose the bullet entered the right orbit, so severely damaging the right optic nerve that for a long time the eye was thought to be blind. Gradually the traumatic neuritis subsided, leaving sufficient vision for H. to go about alone and do such work about the house as did not require reading or writing. After some years his remaining vision began to deteriorate. When I saw him the following conditions obtained: Pupil 3*mm* in diameter; cornea, lens, and vitreous clear; nerve head white, its large vessels tortuous. The vision was sufficient for H. to see indistinctly the outlines of large objects. For instance, he saw well enough in a proper light to take a glass of water from a tray without striking the tray with his hand. There were no nystagmic movements of the eyeball. The in-

> teresting feature of the case was that the pupil was totally unresponsive to light, although, when the patient was told to look at the tip of his nose the pupil contracted. The tension of the eyeball was above normal, which probably accounted for the late increasing diminution of vision. The papilla showed not the slightest cupping and this was so because of the changes produced by previous traumatic neuritis. This also accounted for the fact that there was a general diminution of vision over the whole field and for the further fact that there had developed no gradual contraction of the visual field. The increased intraocular pressure was evenly distributed over the whole retina, which was not subjected to a diminution of its vascular supply after the manner which occurs where there is cupping of the disk. Here then we have a retina responsive to light impulses, which impulses are transmitted by the optic nerve fibers all the way back to cortical light centers, and yet, although the mechanism of the third nerve and its centers is intact, we have no pupillary response to these light impulses, while at the same time the pupil responds actively in accommodation. If these observations are correct, then they would seem to show that the optic nerve fibers take no direct part in the production of the primary light reflex.

Let us consider for a moment the conditions present. Here is an eye which sees and in which there are movements of the pupil when the patient is told to look at the tip of his nose. The size of the pupil is abnormally large, but it is not widely dilated. There has been a traumatic optic neuritis and the intraocular tension is higher than normal. The condition of the nerve head shows that many of the optic fibers have atrophied and with them their retinal prolongations. Enough, however, have escaped to allow of an imperfect perception of large objects. The size of the pupil is what we should expect it to be when the autonomic reflex, *i. e.*, the primary response to light is removed, while at the same time there is no paralysis of either the motor fibers to the pupil or of the fibers which regulate the dilatation of the pupil. The abolition of the primary pupillary reflex in such a case as this removes the normal pupillary hippus and results in partial dilatation of the pupil. It does not result in complete dilatation of the pupil because the retinal pigment layer is not entirely destroyed, there being still circulation in the retinal vessels. Here then we have an example of the tonic influence of the retinal pigment layer on the functioning of the ciliary ganglion even though the retinal pigment layer is not capable of the normal accurate function of its activities. Compare this with the next case, which owing to complete absence of retinal circulation there has been removed not only the active normal functioning of the pigment cells but an abolition of all function. There is no response on the part of the pupil to light because the increased intraocular pressure has stopped the activities of the retinal pigment cells. There is still light perception because the pressure has not been great enough to entirely destroy the functions of the retinal ganglion cells. Thus it would seem that we have pathological proof of the claim, that the primary pupillary response to light belongs to the autonomic system and is negotiated by the intraocular structures, the ciliary ganglion, and the iris, without the assistance of the optic nerve and the intracranial structures so long as these latter are normally performing their functions.

Etta G., full-blooded negress, married, aged 44. Eyes show the following conditions: Both pupils dilated *ad maximum*, and are totally irresponsive to light, directly and consensually, but do contract when patient looks at the tip of her nose. Patient can count slowly, with either eye, fingers held about a foot away. Both visual fields seem to be abolished save for a very small region directly in front of the eyes, showing that save just at the macula, the retina is not functioning. Both fundi present a picture rarely seen by the ophthalmologist. The right nerve head is snow-white and not excavated. At first glance no trace of a vessel, artery, or vein, can be seen on the disk, but by getting before the eye the lens which by the direct method gives the best view of the details of the disk, two very faint threads can be seen running, one upward, the other downward, from the center of the disk. Unless much care is exercised these remains of the first division of the central artery cannot be made out and the papilla looks like a large pure white disk set in the midst of an evenly mottled dark background. At first glance the retina seems to be devoid of vessels, either arteries or veins, but two minute whitish threads, although larger in diameter than those in the disk, can, under close inspection, be traced in the retina for a little more than a disk's distance, one running upward and outward and the other downward and outward. There is no visible disturbance of the retinal pigment of either eye. The left eye shows a condition identical with that of the right except

> that two minute threads on the disk have a very faint broken pinkish line along their centers. How circulation through the retinal vessels sufficient to admit of any central vision, however slight, is kept up is difficult to understand in the presence of what is apparently complete obliteration of the retinal vascular system. The retina in neither eye shows any areas in which there is visible disturbance of the retinal pigment. Both eyeballs are hard, tension about + 1.

No history of the case is obtainable, save that the loss of sight was more or less gradual. Here is a case in which a person can count fingers at a distance of twelve inches and in which there is no paralysis of the motor nerves to the pupil as shown by the response of the pupil in convergence and yet in which the pupil responds to light neither directly nor consensually. This case might be considered one of the Argyll-Robertson pupil variety. It is not, however, an example of the true Argyll-Robertson pupil. In the case under discussion, the lack of direct response on the part of the pupil to light is due to the abolition of all response on the part of the pigment cells; not only of all response, but also to destruction of the retinal pigment layer, there being no circulation in the retina. There is thus destroyed the retinal pigment layer tonic influence in the ciliary ganglion and so there results complete dilatation of the pupil. I have never seen another case presenting an exactly similar picture in the fundus. The nearest approach to it have been the results of extensive syphilitic arterio and venous changes. In these cases, however, there have been visible some evidences of changes in the retina at places along the vessels. I have seen only two or three cases of quinine amblyopia, but in no one of these was the vascular obliteration comparable to that of the picture shown in this case. The absence of the consensual light reflex in the case of Etta G. is due to the fact that there is nothing to call it into existence, the two pupils remaining constantly the same size whether one or the other, or neither, or both, of the eyes are excluded from the light. The absence of the consensual light reflex in the contracted pupils of the true Argyll-Robertson type is to be similarly explained. This has been fully discussed elsewhere (Archives of Ophthalmology, vol. xlvi., No. 3). The absence of the direct response to light in the Argyll-

Robertson pupil is due to lesions within the ciliary ganglia which prevent the impulses from the retinal pigment cells from reaching the motor elements of the ganglia.

> Take the case of A. E., aged 47. In 1910 an iridectomy was done on his left eye for simple chronic glaucoma. Prior to this time the vision of this eye had been growing gradually worse for eighteen months or more. A deep excavation occupying the outer five sixths of the disk was present. The main upper and lower retinal arteries and veins were constricted as they came from under the edge of the disk. Two small arteries and veins came through the nerve tissue of the inner one sixth of the papilla both above and below and were not constricted. Vision $\frac{18}{150}$. Right eye normal. Condition in November, 1918: Vision $\frac{18}{70}$. Extensive scotoma for nasal half of the field. A drawing had been made of the appearance of the disk in 1910 and apparently it had undergone no change during the intervening eight years. Right eye, vision normal; iridopsia when used for prolonged close work; tension and fundus not demonstrably abnormal. The pupillary movements are in every respect normal, including those constant delicate dilating and contracting movements (hippus) which are to be seen in all normal young eyes. Left eye shows a clean iridectomy. Along the edges of the iris are to be seen none of those oscillating movements just mentioned as visible in the right. At one visit so far as I could make out under a magnifying lens, the eye being examined before a window in bright daylight, there is no pupillary movement of any kind when light is thrown on the fundus, *i. e.*, there is entire absence of the primary pupillary response to light. At another visit, the intense light of an electric lamp being thrown upon the fundus, there could be made out a faint response on the part of the pupil. The consensual response from the opposite eye, however, is active. Light thrown on its fundus also calls forth the production of the consensual pupillary response in the right eye. The pupil contracts when E. looks at the tip of his nose, *i.e.*, in convergence. The pupil responds actively when light is thrown upon the fundus of the right eye.

Here then is an eye, which not only perceives light, but the details of objects, as shown by a vision of $\frac{18}{70}$. This fact shows that the tract from the retina along the optic nerve to the light perceiving centers in the cortex is not destroyed. Here is an eye which when light falls upon the still sentient parts of its retina awakens a consensual response in the pupil of the opposite eye. This shows that the nervous pathway from the retina to the motor third nerve nuclei is not entirely destroyed. Here is an eye whose pupil responds in convergence and also actively responds, consensually when light falls upon the fundus of the opposite eye and also responds consensually with convergence contraction of the opposite eye. This fact shows that the third nerve and its nuclear connections are intact. And yet, in this eye, there is no normal hippus, and at times even in bright daylight, as far as can be seen, an entire absence of all direct pupillary response to light falling upon the retina; while at other times, although the direct response to an intense light is present, it is so slight as to require close observation to detect it. In a healthy eye after a clean iridectomy has been done the pupillary response is normal, save that it cannot produce a round pupil. The absence of the direct response to light in this case cannot be said to be due to the iridectomy, for all of the other pupillary responses are not only present, but actively so. It cannot be said that the absence or the very faint direct pupillary response to light is due to atrophy of the optic nerve fibers for the eye has a vision of $\frac{18}{70}$ and the optic nerve transmits sensations to the third nerve nuclei sufficiently powerful to produce a consensual response in the opposite eye. No one will claim that the intraocular pressure which cupped the disk destroyed those fibers of the retina to the third nerve nuclei which produce the direct pupillary response and yet those fibers which produced the consensual response escaped. What then is the explanation of the absence of the normal hippus and the direct response to light? I can imagine but one answer which satisfies. And this answer is that the intraocular pressure has so damaged the activities of retinal pigment cells as to render impossible the primary or autonomic pupillary light reflex, save in response to an intense illumination, such as, the rays from a strong electric light held close to the eye.

In the future history of this case, there will be an entire and permanent absence of the primary light reflex, while there are still vision and sufficient vitality of the retinal visual cells to produce the consensual reflex in the opposite eye. When finally blindness sets in there will of course be not only an absence of the direct pupillary response to light impulses, but also the loss of retinal power to cause a consensual reflex in the opposite eye. There will, however, remain the consensual, accommodative, and convergent reflexes in response to impulses originating in the opposite eye. We must bear in mind that functioning retinal cells and functioning pigment cell layers (whether the cells contain or do not contain pigment granules is immaterial. Witness the albinotic eye) are both necessary for the production of the primary light reflex. Completely destroy the retinal cells and no primary light reflex is possible. Destroy the function of the retinal pigment cell and no light reflex is possible. This latter, which we have tried to show, occurs in the late history of simple chronic glaucoma.

Simple chronic glaucoma occurs in two classes of eyes: (1) those in which the conditions admit of an increasing excavation of the nerve head; (2) those that do not admit of this increasing yielding of the papillary structures. The second class of cases I can recall examples of only in eyes which had been previously subject to optic neuritic changes. In the former cases the field of vision as stated above contracts in the earlier stages in a great measure pari-passu with the pressure upon the retinal arteries as they pass over the papillary ring. In both cases the increasing intraocular pressure seems to obliterate in those parts of the retina which escape atrophy from lack of direct nutrition from the vessels the finer activities of the retinal pigment cells sooner than it does that of the retinal ganglionic cells. The proof of this is to be found in the obliteration of the response of the pupil to light before the entire destruction of vision.

Lastly, compare the case of Y., aged 37. Five years previous to visit sight of right eye "went out in about three weeks." Examination of fundus revealed optic atrophy, with retention of the retinal circulation; the retinal arteries and veins showing only slight deviations from the normal in the size and regularity of outline of lumen. With this eye Y. can distinguish between light and darkness, but can see no object whatever; for instance, she can tell when the gas jet in a room is lighted, but cannot tell the direction from which the light comes, nor is there any perception of outlines of objects. The vision of the left eye is normal. Both pupils are normal in size and equal. Both respond directly, consensually, and in accommodation. When the left eye is

> closed the right pupil dilates more than the left pupil does when the right is closed. In the same way the consensual response of the right eye is more active than that of the left. In other words, if the left eye be closed the pupil of the right eye increases its diameter by 1*mm;* when, on the other hand, the right eye is closed, the left pupil dilates, but the aid of a magnifying glass is required to see the movement, which, however, is distinct. This only shows that the amount of impulse passing from the retina along the right nerve to the third nerve nuclear region is less than that under the same degree of illumination passing along the left side to the third nerve nuclear region, and also that the activities of the retinal pigment cells is less for the diseased eye than for the healthy one; the former regulating the consensual reflex; the latter, *i. e.*, the activities of the retinal pigment cells, the direct pupillary response to light. Cases such as this are seen every day in practice and this one is repeated here for comparison with the cases above reported and commented upon, *i. e.*, those cases in which an eye can see and the pupillary motor nerve tract, in so far as it is represented by the retina, optic nerve, third nerve centers, and motor ocular fibers to the pupil, are all functioning and yet the pupil does not respond to light impulses. This case is reported in contrast with that of L. (*vide supra*). In one case we have partial optic atrophy with increase of intraocular tension; in the other partial atrophy in an eye with normal tension.

In the case of G. H. (*vide supra*), where all of the pupillary reflexes were abolished as the result of pressure upon the root of the iris, it was noted that after the iridectomy had lessened the intraocular tension, gradually all of the pupillary reflexes returned.

Whether in a case of simple chronic glaucoma, which has progressed to the point where the primary light reflex has been abolished, this reflex can ever be restored as the result of an operation, I am unable to say. How far the condition of the pupil will help us to select the type of operation in any given case, I am as yet without sufficient experience to state.

> Or, again, take the following excerpt from the case of G., aged 36. On the tenth day after the onset of an attack of quinsy, while the tonsil was still inflamed, she began to be conscious of a sensation of pain behind her right eye, a pain which forced movements or pressure upon the eyeball accentuated. When she awoke the following morning, she found she was entirely blind in this eye. Examination the same

afternoon showed retrobulbar neuritis, which manifested itself by a blurring of three fourths of the pupillary edge and interference with the circulation in the retinal veins. The eye was totally blind. There was complete abolition of the primary pupillary reflex and of the power to originate the consensual reflex in the opposite pupil. The consensual reflexes, however, generated by the retina of the healthy left eye were retained in full activity by the right eye. Five days later the vision had so far returned that the patient was able from the outer quadrant to imperfectly count fingers at one foot. The primary pupillary response to light was still entirely absent but the impact of light on the retina could apparently originate the consensual reflex in the left pupil. When light was excluded from the left pupil the right pupil became semi-dilated and immobile. How are we to interpret these pupillary symptoms? They show clearly that light impulses passing along the optic nerve are powerless to originate the primary light reflex: for (1) in this case, light impulses pass along the optic nerve, as is demonstrated by the patient's ability to count fingers; (2) apparently the light impulses reach the third nerve nuclei, for they seem to generate the consensual pupillary response, in the opposite eye, and yet the primary pupillary reflex is absent. That the pupil is only semi-dilated when all light is excluded from the opposite eye shows that the retinal pigment layer is nourished but is incapable of its normal variation in response to activity in the retinal ganglion cells because, in turn, of the functional disturbances in these ganglion cells caused by the retrobulbar pressure in the optic nerve fibers. In other words, were these retinal pigment layers abolished the pupil would be fully dilated. That the retinal ganglion cells and their prolongations are sufficiently active for light impulses to reach the optic brain centers, although there is still absence of the primary pupillary response to light, shows that there is still loss of the normal variation of function in the retinal pigment cells, which variation in function is a *sine qua non* of the primary pupillary response to light.

This case was repeatedly observed with much care. A thick wad of cotton was held firmly over the closed lids as the most satisfactory way of excluding all light from the sound eye while the monolateral responses of the right pupil were examined. An electric flash light was set in a thick paper mailing case, one end of which was shaped so as to fit accurately to the brow, nose, and cheek. This was used in testing whether the diseased retina was still capable of originating a consensual light reflex in the opposite eye. The normal hippus of the left pupil made the certain determination of the presence of this consensual reflex less easy than one would think. At times there would seem to be no question of the presence of this reflex, at other times it would seem to be absent. This was especially true from the tenth to the fourteenth day of the beginning of the retrobulbar inflammation. The cloudy swelling which at first was confined to the immediate vicinity of all but the inner one fourth of the disk margin gradually increased until it involved the whole edge of the disk and extended into the retinal tissues above and below for as much as half a distance. This was accompanied by a corresponding dilatation of the big retinal veins. At the time, although there was distinct perception of light for the outer part of the field, the patient volunteered the information that the amount of vision varied greatly at different times of the day; at times she was uncertain whether she could see light at all. On the fourteenth day although the vision had not materially improved, the primary light reflex and its hippus returned in the right eye, although not so actively as they were in the left eye. Note the return at the same time of the primary light reflex and its accompanying physiological variations which we term hippus. The explanation of this is that the swelling in the optic nerve had subsided sufficiently to allow of the physiological interactivities of the ganglion cells and the pigment layer cells. The ever varying hippus of a normal pupil tells of the impulses sensory, motor, and sympathetic, of varying intensity which are constantly reaching and being discharged from the ciliary ganglion.

In examining the pupillary reflexes in such eyes as those which form the subject of this paper, one must bear in mind that inflammatory pressure upon the optic nerve fibers or retina allows only a relatively small amount of retinal impulses to pass backwards and we get, therefore, only a feeble response from the central nuclei and the cortex. This renders it difficult to be sure whether or not the pupillary movements in the sound eye, although they are apparently the consensual reflex, are not in reality only a part of the normal hippus. This is especially true in a case of a young person whose nervousness renders the hippus abnormally active. This accounts for the frequent use of the word "apparently" in the course of this article.

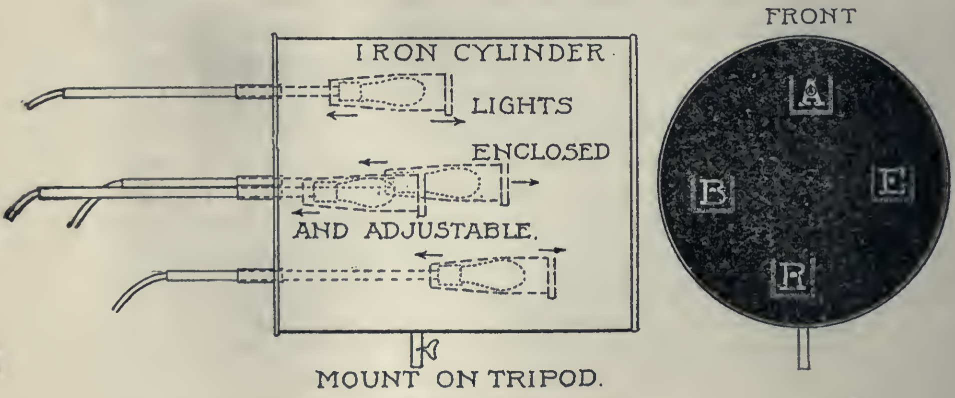
A DEVICE FOR THE EXAMINATION OF DISTANT STEREOSCOPIC VISION FOR FORM AND COLORS.[1]

By Dr. MARTIN COHEN, New York City.

(*With one illustration in the text.*)

THE use of the stereoscope in conjunction with a stereoscopic test card is the method usually employed for the examination of aviators' stereoscopic near vision; this examination, however, does not fulfill the requirements for distant stereoscopic vision, which is most essential.

Individuals with muscular imbalance for distance only, can successfully pass the near stereoscopic test while they generally fail in the test suggested by the present device. The principle involved in this instrument consists in the placing of certain letters or colored glasses at definite distances in space, thereby representing volume and visualizing a natural perspective. This simple apparatus, as illustrated, is made as follows:



(½ inch = 1 inch)

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[1] Presented at meeting of Section on Ophthalmology, New York Academy of Medicine, November 18, 1918.

Four white letters with a black background are selected from Snellen's test card of the $\frac{20}{40}$ or $\frac{20}{30}$ line. These letters are placed at the extremity of four $\frac{1}{8}$-inch black tubes ten inches in length, allowing the letters to be readily moved back and forth at definite distances by withdrawing or advancing the inner tube from the rear. The far ends of the tubes are inserted through a black metal disk 11¼ inches in diameter, and the tubes are located two inches from the margin of the disk,—namely, above, below, and laterally, but not on the same place. The instrument is encased in a black hollow cylinder, so as to avoid shadows, and attached to a movable stand.

In order to obtain a standard of luminosity for the letters and colors, they are mounted on glass in individual encasements, with suitable posterior illumination.

The tubes are graduated and can as stated be drawn backward from the rear to secure any definite antero-posterior displacement for each letter or color.

Since the presentation of this device, I have been investigating the effect of various colors arranged stereoscopically, in order to ascertain its practicability. The colored thin plate glasses or colored isinglasses can be readily inserted where the letters are located.

The examination of the individual is conducted as follows: He is placed at thirty or forty feet from the instrument, depending upon the size of the letter indicated above the Snellen test card which is used. A mirror can be intercepted if necessary. Both eyes are directed on a level with the center of the instrument. In emmetropia, the antero-posterior displacement of each letter is two inches when using Snellen's test card of the $\frac{20}{40}$ line; the lateral displacement of four inches is not varied in this device.

The individual is then requested to call off the letters or colors as they appear nearest to him, after waiting for a few minutes to allow for his visual adaptation. In examining several individuals at the same period and to avoid the memorizing of the letters, an interchange of letters or colors is readily made. This apparatus can be used for applicants seeking positions in which distant stereoscopic visual acuity and color sense are considered essential.

THE JAW WINKING PHENOMENON AND ITS EXPLANATION.

BY DR. ANTON LUTZ, HABANA.

(*With one illustration on Text-Plate VII.*)

UNDER the name of "Jaw Winking Phenomenon" we understand the curious and very striking appearance of retraction of the upper eyelid, during movements of the jaw, of the face, of the pharynx, and of the tongue.

Since the first description by Marcus Gunn,[1] there have appeared about ninety observations in the literature of the subject. A comparison of them gives us the following conclusions:

1st. The "Jaw Winking Phenomenon" appears more frequently in the male than in the female sex; in the majority of cases the retraction occurs on the left side.

2d. The retraction takes place, as a rule, on one side only; in two cases it was found to be bilateral: Adamück[2] and B. Harman.[3]

The case of Beaumont,[4] which is referred to in some papers as a bilateral case, can only be considered as a case of normal concomitant movements.

3d. The majority of patients tell us that the phenomenon was already in evidence at the time of their birth and that it continued during their lifetime without any alteration. In seven cases the phenomenon developed in later years; these are the cases of Block[5]; of Kraus[6]; of Menacho, when it appeared in the twelfth year[7]; of Friedenwald, in the sixth year[8]; of

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[1] *Transacts. of Ophth. Soc. U. K.*, 1883.

[2] *Klin. Monatsbl. f. Augenh.*, 1888.

[3] *Ophthal. Soc. U. K.*, 1903.

[4] *Lancet*, 1893.

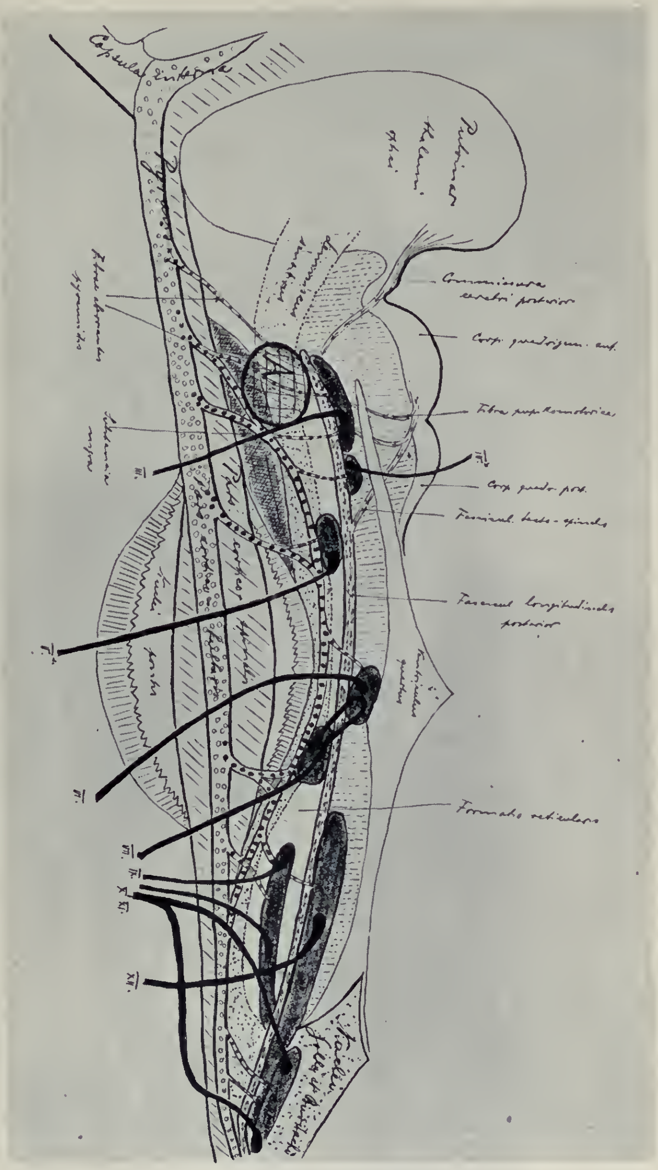
[5] *Nederl. Tijdschr. v. Geneesk.*, 1891.

[6] *Dissert.*, Göttingen, 1881.

[7] *Annales d'Oculistique.*

[8] *Centralbl. f. A.*, 1896.

ILLUSTRATING DR. LUTZ'S ARTICLE ON "THE JAW WINKING PHENOMENON AND ITS EXPLANATION."



(*Sketch after Déjérine*)

Fränkel, in the thirteenth year[1]; of Uhthoff, in the sixth year[2]; and of Cantonnet,[3] in the twenty-first year, when it suddenly made its appearance in a soldier after the extraction of a tooth, together with diplopia and transient facial palsy. The patient of Gaultier and Bucquet[4] acquired it at fifty-five years; he was diabetic and awaked one morning feeling somehow ill and congested; the left side of his face and of his entire body felt cold; the left half of his face had a violet aspect, arm and leg had normal color; he quite soon improved, so that he could go to his daily work; coming back for lunch, his children began to laugh at his funny left eye. In the case of Fränkel the phenomenon showed some improvement after a few years; it even disappeared altogether, in the case of Gunn; in the case of Kraus the retraction of the upper eyelid disappeared but the ptosis continued. The phenomenon became more marked, with time, in the cases of Block and Adamück.

4th. The phenomenon also sometimes appears in several members of the same family. Thus, Meyer[5] observed the same phenomenon in father and daughter; Block noted it in two brothers.

5th. The phenomenon can best be observed when the patient looks downward, and becomes invisible during elevation of the sight. When a normal person looks upward the cornea touches the margin of the elevated lid and there is no space left to admit of the retraction being seen.

6th. The retraction is in nearly all cases involuntary. In only one case, which I described in *Kl. Monats. f. Aug.*, 1914, could the patient also produce the phenomenon voluntarily, without any movement of the jaw, through intense downward looking. In no case, of those published to date, could the phenomenon be suppressed at will.

7th. The phenomenon appears very rarely alone without other complication. Such cases, however, are those of Fuchs,[6] Just,[7] Fränkel, Van Lint,[8] Wilbrandt,[9] and Stephenson.[10] All the muscles of the lid and of the eyeball functioned absolutely normally and the phenomenon was only produced by movement of the jaw. In the case of Clarke it was produced without any movement of the jaw, through intense downward looking. Generally the phenomenon is accompanied by involvement of some of the eye muscles, especially those of the lid. About eighty per cent. of the cases show ptosis, whether complete or incomplete (Sinclair[1]), *i.e.*, visible only upon elevation of the lids. The retraction of the eyelid preceded the appearance of the ptosis in the case of Fränkel by about five years; in the case of Cantonnet the retraction followed the appearance of ptosis about fifteen years later. The mobility of the eyeballs is generally normal; but there is also found paralysis of different muscles (about twenty observations),—mostly of the rectus superior; far more rare are those of the rectus internus, rectus externus, obliquus superior, and obliquus inferior. Vossius[2] saw it in one of twins who each had a complete bilateral ophthalmoplegia externa congenita. These paralyzed muscles of the eyeball never show such concomitant movements as the levator palpebræ sup.; they mostly show an incomplete paresis. The internal eye muscles were never affected in congenital cases, so far as I could learn from the literature of the subject. In the cases of Demaria and Caldora[3] and of Gunn, an anisocoria existed, but no alterations of the pupillary reactions. The case of Rampoldi[4] is an exception: the raising of the lids was produced by clonic convulsions,—the lid of one eye fell while the other went up; the pupillary reactions were normal, but the pupils contracted during opening of the lids and dilated during closing the palpebral space; the irregular clonic contractions of the lids and pupils persisted during sleep. This case suggests an athetosis and has probably its own etiology (lesion of the pedunculus cerebel anterior and nucleus ruber).

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[1] *Kl. M. f. A.*, 1888.

[2] *Berliner kl. Wochenschr.*, 1888.

[3] *Archiv. d'Ophtal.*, 1909.

[4] *Gazette des Hôpitaux*, 1911.

[5] *Recueil d'Ophtal.*, 1889.

[6] *Heidelberg. Gesell.*, 1888.

[7] *Berliner kl. Wochenschr.*, 1888.

[8] *Soc. Belge d'Ophtal.*, 1908.

[9] *Neurologie d. Aug.*

[10] *Ophthalmoscope*, 1908.

In the case of Wecker there existed further a certain rigidity of the jaw; the patient was unable to open his mouth like normal people.

Uhthoff observed in his case a slight contracture of the facialis of the same side without any change in the electrical reactions.

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[1] *Ophthal. Rev.*, 1895.

[2] *Beiträge z. Aug.*, 1892.

[3] *Soc. de Oftal. de Buenos Aires*, 1917.

[4] *Annali d'Ottalmol.*, 1884.

8th. The retraction of the eyelid is a pathological appearance; under normal conditions it cannot be observed in healthy people; consequently it differs fundamentally from the concomitant winking contractions of the orbicularis oculi, which follow so often a facialis paralysis; this latter represents an absolute normal movement which any normal man can voluntarily produce; it is only connected with erroneous impulses. In acquired cases the Jaw Winking Phenomenon appears suddenly, the facialis concomitant movements occurring only a few weeks after the injury, corresponding to the time necessary for the nerve fibers to renew their growth in the new paths.

9th. In the majority of cases the phenomenon can be produced by lowering the jaw, in speaking, singing, and chewing. It is only produced by opening the mouth; never by closing it. In about the same number of cases it is produced by moving the jaw downward and to its opposite side. In rare cases it is produced by lateral movements of the jaws. Far more seldom are the cases in which it is produced by laughing, blowing the cheeks, sucking, swallowing, or thrusting out the tongue: Hubbel,[1] Meyer, Block, Grimsdale,[2] Lutz, Cokayne,[3] Zimmermann[4]; it was produced by simple lateral movements of the eyeball in the cases of Pick[5] and Pflüger[6]; and what is more surprising, by closing the lid of the contralateral side in the cases of Bull,[7] of Marbaix,[8] of Higier,[9] and of Von Reuss.[10] These latter cases prove that the Jaw Winking Phenomenon is not only produced by innervation of the nuclei of the same side, but also by that of the contralateral side.

These clinical observations show us that the retraction of the eyelid is associated with innervation of the trigeminus, which lowers the jaw by the musculus mylo-hyoideus and the anterior part of the musculus biventer, and which produces lateral movement of the jaw by the musculus pterygoideus externus; with that of the abducens (musculus rectus externus), with that of the facialis (musculus risorius and buccinatorius, as well as orbicularis oculi and posterior part of the biventer); with that of the glosso-pharyngeus and vagus (m. constrictor pharyngis); finally with that of the hypoglossus which thrusts the tongue out of the mouth by the action of the m. genioglossus. The musculi masseter, temporalis, and pterygoideus internus innervated by the trigeminus cannot produce the phenomenon.

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[1] ARCHIVES OF OPHTHAL., 1893.

[2] *Transactions U. K.*, 1902.

[3] *British Journal of Children's Diseases*, 1914.

[4] *Am. Journal of Ophthal.*, 1918.

[5] *Deutsch. med. Wochenschr.*, 1905.

[6] *Heidelberg. Gesell.*, 1892.

[7] *Kl. Monatsbl. f. Aug.*, 1888.

[8] *Soc. Belge d'Ophtal.*, 1908.

[9] *Deutsch. Zeitschr. f. Nerven.*, 1902.

[10] *Weiner kl. Wochenschr.*, 1889.

10th. All these cases, the congenital as well as the acquired, have a common feature, namely that the abnormal movement of the lid occurs with the so-called principal movements of Munk (such as chewing, swallowing, laughing) which are already developed in the first days of the newly born infant, and whose centers must be searched for in the thalamus opticus. The Jaw Winking Phenomenon is never found together with the separate movements of Munk, which develop only later together with the cortex cerebri, *e.g.* wrinkling of the forehead.

11th. The operative treatment of the Jaw Winking Phenomenon, in which the methods of Angelucci, Hess, and Lapersonne were used, only resulted, as far as I could see from one personal observation and a few reports in the literature, in correcting the ptosis. The retraction of the eyelid remained unaltered or appeared again soon afterwards.

Various opinions have been expressed as to the etiology of the Jaw Winking Phenomenon:

(*a*) Adamück[1] alleges a stasis venosa in the chewing muscles. Castellanos[2] believes it to be produced by abnormal insertion of the eyeball muscles in the orbit. Demaria and Caldora speak in favor of a lesion residing in the intercortical association fibers of the frontal convolutions.

(*b*) Some authorities consider it to be only an abnormally strong but physiological concomitant movement. Against this latter opinion we recall that normal people cannot retract the lids so far backward, nor can they do so on one side only.

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[1] *Kl. Monatsbl. f. Aug.*, 1888.

[2] *Vida Nueva*, 1915.

and that this concomitant movement is restricted to only one muscle, not to an entire group of muscles as is observed in normal physiological concomitant movements, *e.g.* in children with inflamed eyes when they are asked to open them, opening the mouth at the same time,—or in pathological concomitant movements, *e.g.* after hemiplegia. The real concomitant movements are always bilateral and can be observed in any child under three years, in whom inhibitions are not sufficiently developed. If we show to a young child a shining object, it always stretches both hands towards it. These concomitant movements appear in the rule after trauma in the brain, *e.g.* through encephalorrhagia in later years, as consequence of the loss of certain inhibitions.

(*c*) Bishop Harman[1] tried to explain it as an atavistic phenomenon. He considers the Jaw Winking Phenomenon "as a revival of an old-time and long-accustomed associated movement." He reminds us that in lower animals the nucleus facialis and the nucleus masticatorius form a single nucleus, and that the movements of the jaw and of the nostril work always together. And really, physiology tells us that strong opening of the mouth, *e.g.* in yawning, is accompanied by the action of the musculus tensor tympani (V), Politzer, meanwhile closing of the eyes is accompanied by the action of the musculus stapedius (VII), Lucæ. But he believes the Jaw Winking Phenomenon to be produced by a loss of equilibrium between the levator and the depressor palpebrarum, inasmuch as during the action of the pterygoidei, the orbicularis is relaxed and the more feeble levator can come into play. Against this opinion we must remember that it is not the orbicularis but the levator palpebræ which shows a lack of relaxation, as is best illustrated by the fact that some patients experience a resistance when trying to close the lids.

(*d*) The English Commission (1884) which studied the case of Gunn explains the phenomenon in the following manner: The musculus levator palpebræ receives not only fibers from its own nucleus, but also from the motor part of the trigeminus which is situated very near to that of the oculomotorius. The majority of observers adhere to this explanation for the congenital cases of Jaw Winking Phenomenon; for instance, Pontico,[1] as well as Bielschowsky in *Graefe-Saemisch*. It, however, needs more ample consideration. This theory presupposes one cerebral center to be supplied by another, and it contradicts an old law in anatomy that a muscle does not change its primitive nerve supply, though it can change to a new position or acquire a new function. We should remember, furthermore, against this explanation, the following points: 1st. It is very surprising that only the levator palpebræ superioris receives these supplementary fibers, and not also the rect. sup. forming the fibers of the levator palpebræ superioris and those of the rect. sup. together with the ramus sup. of the oculomotor nerve. 2d. If his theory were correct, the levator palpebræ superioris should in many cases receive the supplementary fibers, not only from the nucleus masticatorius alone but also from the nuclei VI, VII, IX, X, XII, which are situated at a distance,—and this is very improbable. 3d. The theory cannot explain why the phenomenon appears in many cases so suddenly, *e.g.* in the case of Cantonnet; that it grows worse, better, or even disappears. It is difficult to understand, according to this theory, why the supplementary fibers did not function before the appearance of the Jaw Winking Phenomenon, or why they lost the function after the disappearance of the retraction of the eyelid. 4th. In some cases ptosis preceded, in other cases ptosis followed, the appearance of the Jaw Winking Phenomenon. These observations are contradictory, in that the normal innervation of the levator should undergo changes, while an abnormal origin functions well.

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[1] *Ophthal. Rev.*, 1901.

Helfreich[2] came independently to the same conclusion as the English Commission, and expressed the opinion that these supplementary fibers traveled in the fasciculus long. post.

(*e*) Bielschowsky, who adheres for the congenital cases to the opinion of Helfreich, believes that the acquired cases of abnormal lid movements appearing in the recession of basal oculomotor nerve diseases are produced in a similar manner as the concomitant movements of the lids after peripheral facial palsy. These acquired cases are characterized by the basal seat of the lesion. Clinically, they show, during innervation of certain muscles of the eyeball (especially adduction), a retraction of the lid. Bielschowsky and his pupil Eppenstein explain such cases on the ground of the experimental investigations of Lifschitz. Lifschitz[1] proved anatomically that after peripheral lesion of the facialis, the regenerating fibers found their way during the healing process into the old sheaths of Schwann and that they did not always return to the same muscles as before, but, in greater or lesser numbers, remained in foreign muscles. The analogy of these acquired cases with those of congenital Jaw Winking Phenomenon is so surprising that one may be tempted to explain the Jaw Winking Phenomenon in the same manner. That this opinion cannot be accepted in such cases as, for instance, Cantonnet's, we may conclude, from the following points: 1st. The concomitant movements of the eyelid after facialis palsy are movements which any normal man can perform; they appear only in an irregular manner together with another desired movement, because the various muscles are no longer innervated separately by their fibers. On the other hand, the retraction of the eyelid in the Jaw Winking Phenomenon is quite an abnormal movement which no normal man can produce. 2d. If the phenomenon were produced by erroneous growing of the regenerating fibers of the roots of the bulbar nerves through the old sheaths of Schwann into the path of the roots of the oculomotor nerve, we should expect, not a concomitant movement of a single eye muscle, but of a series of muscles, especially of those which show paresis, *e.g.* rect. sup.; consequently we should find an irregular movement of the different muscles of the eyelid as well as of the eyeball, because the independent action of one muscle is no longer possible. 3d. We should further observe an abnormal play of the internal eye muscles in the same manner as of the external, and this is contrary to the facts. 4th. This theory cannot explain why the phenomenon appears sometimes instantly after a trauma, because the regeneration of nerve fibers always requires some time. 5th. Against an infranuclear seat of the lesion in congenital Jaw Winking Phenomenon speaks further the fact that it was found in two cases on both sides.

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[1] *Thèse de Paris*, 1910.

[2] *Heidelberg. Gesellsch.*, 1888.

The explanation of peripheral abnormal growing of nerve fibers has much in its favor, as to cases of retraction of the eyelid in adduction of the eyeball, *e.g.* after basal brain affections, but for the above-named reasons we cannot use it for the congenital Jaw Winking Phenomenon.

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[1] *Monatsschr. f. Psych. u. Neur.*, 1906.

(*f*) In two previous papers[1] I spoke in favor of a supranuclear lesion as explaining the Jaw Winking Phenomenon, emphasizing always that the lesion should be expected in the neighborhood of the nuclei on account of the paresis of the other eye muscles which behave like nuclear lesions. In favor of such a theory we can remember: 1st. Ptosis and other symptoms can completely fail, and in these cases Helfreich's theory cannot explain why the levator palpebræ sup. had so many supplementary origins or why the fibers of the nucleus masticatorius had found their way to the musculus levator palpebræ. Lifschitz's theory could not explain the origin of the abnormally regenerated fibers. 2d. In almost all cases the pupillary functions are not altered, which finds its explanation in the fact that the involuntarily acting nucleus sphincter iridis receives its orders from the corp. quad. sup. ant. through fasciculus tecto-bulbaris and in that the other voluntarily acting eye muscle nuclei receive the irritation through the pyramidal tract. 3d. In the cases complicated with ptosis the eyelid is only paralyzed as to voluntary innervation, but not as to involuntary retraction during the phenomenon. Furthermore, we can very often observe an incomplete relaxation of the levator palpebrarum when the eyelids are slightly closed, and this speaks more in favor of a spastic than a flaccid palsy. 4th. The vehemence of the retraction, which cannot be found in normal eyes, and which tends to show furthermore the preëxistence of a normal infranuclear path. If Lifschitz's theory were applicable, we should observe feeble and irregular retractions of the eyelids, such as we see in the facialis concomitant movements. 5th. The phenomenon represents a disturbance of coördination, inasmuch as normal people cannot lift one lid alone, though the majority can close one eye alone. 6th. In one of my cases the phenomenon could be produced voluntarily without the slightest movement of the jaw, etc., by simply looking downward, while the other paretic eye muscles did not show any concomitant movements. This could hardly be possible if the infranuclear path were the seat of the lesion.

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[1] *Kl. Monatsbl. f. A.*, 1911, and *Anales de Oftalmol.*, 1914.

The vehemence of the phenomenon, the fact that it could voluntarily be produced in one of my cases, and the fact that it can be acquired suddenly, induced me to believe that the Jaw Winking Phenomenon is caused by the suppression of a normally existing inhibition. The following sketch after Déjérine (*Sémiologie du système Nerveux*, 1914) gives a better view of where the lesion could be found.

It first suggests one more explanation: If we accept, for example, a lesion in the spot marked with the circle "A," produced by embryonal inflammation or hæmorrhagie, and which was followed by the interruption of the fibra aberrans pyramidis, carrying the voluntary impulse to the anterior pole of the nucleus oculomotorius, we could understand why in congenital cases the paresis of the lid and of the other eye muscles developed; the Jaw Winking Phenomenon could then be caused by part of the regenerating fibers, which erroneously find their way to the levator nucleus instead of to the true corresponding nuclei, V, VI, VII, etc. It would explain at the same time why the pupillary fibers are not affected because their path comes down from the corp. quad. ant.; it could furthermore explain why the infranuclear levator path functions well during retraction although the lid cannot be raised voluntarily. But against such explanations we must record the theory that supranuclear fibers have as a rule a bilateral effect, though we have as yet no proof that their crossed and uncrossed fibers have also really the same effect. It must be remembered that we can observe the bilateral loss of the effect of any corticobulbar fiber only when the interruption takes place at a certain distance from the bulbar nuclei. If the lesion is situated very near to the nuclei we can understand that the focus cuts the fiber of one side but leaves untouched the collateral of the same fiber going on the other side. We record furthermore the few clinical observations in which certain people can move one eye independently of the other, and more especially the experiment of Adamück and Bernheimer, who separated the paired bulbar nuclei by a median section, after which operation the animals could move each eye independently but had lost the synergic binocular movement. But this supranuclear explanation would hardly satisfy us in cases where the phenomenon developed transiently in the regression of a basal oculomotor nerve palsy; so we can readily understand that the focus acts at the same time on the supranuclear as well as on the infranuclear fibers. It would satisfy us even less in cases like Cantonnet's, where the phenomenon appeared suddenly after trauma, for if this etiology were true, we should observe an interval between the trauma and the appearance of the Jaw Winking Phenomenon. We must further remember that the principal movements produce the retraction of the eyelids, while the innervation of the levator palpebræ or of the other paretic eye muscles does not produce any abnormal concomitant movements of the muscles of the jaw, face, pharynx, etc.; that such vice versa movements appeared, as they do in fact in facialis concomitant movements, we could theoretically expect for the reason that the fibra aberrans pyramidis, which normally go to the anterior pole of the oculomotor nucleus, could send, after their destruction, regenerating fibers to the nuclei of V, VI, VII, etc., and thus produce concomitant movements of the muscles of the jaw, etc. This has not yet been observed, and argues likewise against supranuclear origin by destruction of pyramidal fibers. This forces us to look for the lesion in the immediate neighborhood of the bulbar nuclei.

The special fact that the Jaw Winking Phenomenon can make its appearance suddenly argues in favor of interruption of the normally existing path. Also, some clinical observations strengthen this supposition, especially the vehemence of the phenomenon. The English Commission has already pointed out an insufficient relaxation of the levator palpebræ during closing of the lids. In three cases, closing of the lids could even produce the phenomenon in one eye. Some people state that they feel the resistance when they attempt to close the eye. That the dropping of the eyelids in looking downwards is produced not only by gravitation and the anatomical connections of the levator palp. sup. and musc. rect. sup., but in the first place by a central nervous mechanism, is shown in the independent action of these muscles, for instance, during sleep, when the eyeball goes up although the lid falls, as well as in many cases of palsy of elevators of the eyeball where the lids can be well raised, while the eyeball does not follow the impulse.

The experiments of Sherrington[1] have shown that abduction of the eyeball is produced not only by active contraction of the musculus rect. extern., but also by active inhibition of the musculus rect. intern.; this can easily be demonstrated through cutting of the musc. rect. extern.; though the abduction is paralyzed, a convergent eyeball can be reduced to primary position. This experiment explains, furthermore, why we do not find squinting as a consequence of congenital abducens palsy. In the same manner, looking downward is not only produced by active contraction of rect. inf. and obliquus sup. but also by active inhibition of rect. sup. and levator palpebræ sup.; this is best illustrated in cases of facialis palsy, where the eye cannot be voluntarily closed, and where, nevertheless, in looking downward the lid involuntarily drops in the same degree as in normal people. If such inhibition does not take place, retraction must follow. This is another and the chief reason why the Jaw Winking Phenomenon is not to be seen when the patient looks upward. Very convincing, in this direction, is the case of Zimmermann, who saw the phenomenon in an eight-months-old child, during suckling, and where unilateral retraction of the lid ceased when the attention of the child was attracted by an object held before him and moved upwards, though the child continued to drink.

We have seen before that the Jaw Winking Phenomenon is probably not caused by interruption of the aberrant pyramidal fibers, and we may therefore conclude that it is produced by a difficulty of the inhibition path traveling in the fasciculus long. post. That in this important association bundle inhibition paths are to be found, is shown by observing, for instance, that during closure of the eyelids by innervation of the facialis, an active relaxation of the levator palpebræ takes place. To the same group of observations pertains the relaxation of the levator palpebræ in normal abduction of the eyeball. If we accept, as the cause of the Jaw Winking Phenomenon, interruption or congenital aplasia of such an inhibition path existing normally in all men, and traveling in the fasciculus long. post., we could explain: (*a*) The unilateral appearance, because the chief connection of the nuclei in this bundle is a homolateral one, according to anatomical investigations. In its favor we have further the physiological experience of Sherrington, who tells us "that the march of the spinal reaction tends to transgress the median line more than does that of a cortical reaction, which tends rather to spread unilaterally." (*b*) It would best explain the association of the Jaw Winking Phenomenon with the different brain nerves, V, VI, VII, IX, X, XII. (*c*) The sudden appearance in acquired cases; that it can become worse, better, or disappear. (*d*) That it can be associated with or without any nuclear palsy of other eye muscles. (*e*) That the pupillary fibers function normally. (*f*) That the infranuclear path of the levator functions during retraction. (*g*) That the Jaw Winking Phenomenon could be produced voluntarily without any mastication movement, in one of my patients, simply through intense downward looking. (*h*) In favor of it we can further take into consideration its appearance in different members of the same family.

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[1] *The Integrative Action of the Nervous System*, 1906.

There remains to be explained how retraction of the upper eyelid can appear in the recovery from a fascicular lesion of the oculomotorius. We remember the conclusion of Eppenstein[1] that in these acquired cases the retraction of the upper lid is connected with the innervation of internus and rect. inf., *i.e.*, with movements which are normally accompanied by a relaxation of the levator palpebræ. It has been demonstrated that after the interruption of a branchial nerve, retrograde degeneration follows, with changes in the motor cells of the neuron. We can accept that these degenerations produce a suppression of the inhibition mechanism and that the nervous impulses irradiate to ganglion cells to which normally they should not go. Sherrington showed that inhibition and irritation follow probably the same path and that the difference is probably caused by colloid changes in the separating membrane between the dentrites of the ganglion cell and the termination of the afferent fibers. This inhibition mechanism is easily altered by abnormally strong irritations, and by some poisons,—strychnine, and tetanus, as well as by heat. Inhibition represents a higher function in a neuron chain, and is first destroyed by these poisons. They can even convert inhibition into irritation. This can be illustrated through the tetanic trism: opening of the mouth is produced by active irritation of mylohyoides and biventer (trigeminus) as well as by active inhibition of the far stronger muscles masseter and temporalis (trigeminus). In tetanus this normal inhibition is changed into irritation, and for this reason the mouth cannot be opened. This would lead us to accept a lesion of the inhibition mechanism and subsequent reversion of the inhibition into irritation, as a consequence of retrograde degeneration in acquired cases, and to accept a congenital weakness or aplasia of the inhibition mechanism in cases of congenital hypoplasia of the nuclei, for the congenital Jaw Winking Phenomenon. The lack of development of the nuclei in cases of congenital palsy has been anatomically proven by Wilbrand-Sänger, as well as by Déjérine. The normal impulse going to the different bulbar nuclei would consequently not be accompanied by a normal active inhibition of the levator palpebræ, but by an abnormal irritation, as in tetanus poison. We could further accept that the paretic rect. sup. does not show contraction at the same time, because such an abnormal function is paralyzed by the stronger action of the healthier antagonist.

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[1] *Kl. Monatsbl. f. Aug.*, 1913.

The foregoing clinical comparisons and considerations induce me to believe that the Jaw Winking Phenomenon, in its congenital as well as in its acquired form, is not produced by supplementary fibers of the levator palpebræ sup. originating in other bulbar nuclei, nor that it is produced by abnormal growth of the infranuclear fibers of the roots or of the oculomotor nerve itself; neither that it is produced by such abnormal regenerating of the aberrant fibers of the pyramidal tract, whether they come down from the cortex, as for example in voluntary closing of the eyelids or in involuntarily looking downward, or whether they come down from the thalamus opticus (principal movements), or whether they come down from the nuclear ruber (inferior bulbar reflex movement).

I think that the Jaw Winking Phenomenon is produced by alterations of the supranuclear connections of the bulbar nuclei traveling in the fasciculus long. post., and probably by a lesion of the inhibitive mechanism, just before the dentrites of the damaged nuclear cells of the nervus oculomotorius. The palsy of the other eye muscles, which so often accompanies the Jaw Winking Phenomenon, is then caused by lesions of the nuclei themselves, or of the last unilateral part of the afferent or efferent fibers.

A similar concomitant movement of the lower eyelid has been observed by Herbert Robson (*Lancet*, 1907): "Associated movements of the lower lid with the tongue and lower jaw observed in certain diseases": the phenomenon consists in a slight eversion of the lower eyelids which are displaced about two milimeters from the eyeballs; it is made evident upon protusion of the tongue or depression of the lower jaw, the lids resuming their normal state when the tongue is retracted or the mouth shut. It is in the rule observed in both eyes. It is never present in healthy persons; it comes and goes with the onset and cure of cardiac and abdominal diseases or severe headaches.

I take pleasure in thanking Prof. Dr. José Valdés Anciano, for kindly placing his ample library at my disposal.

OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM.

President, J. B. STORY, F.R.C.S.

ANNUAL CONGRESS, 1919

The next annual Congress of the Society will be held on Thursday, Friday, and Saturday, 1st, 2d, and 3d of May, 1919.

The arrangements will be as follows:

THURSDAY, MAY 1st.

(At the Royal Society of Medicine, 1, Wimpole Street, W.)

Morning.	**President's Opening Address.**
10 A.M. to 12.30 P.M. ...	Papers.
Afternoon.	
2.30 P.M.	Discussion on "Visual Requirements of Aviators." To be opened by Prof. Spearman, Col. Wilmer, U.S.R., and Mr. A. R. Brailey. The following members have also signified their intention of taking part in the Discussion: Messrs. E. C. Clements, A. B. Roxburgh, Col. W. T. Lister, and Col. J. H. Parsons.

4.30 P.M.	Business Meeting.
5 P.M.	Tea.
5.30 P.M.	Bowman Lecture. Prof. V. Morax. Subject: "Plastic Operations on the Orbital Region, including Reflection of the Orbital Cavity, Eyebrows, and Eyelids."
	Members will dine together in the evening.

FRIDAY, MAY 2d.

Morning.	**Visit to the Day Blind School, Brecknock Road, Camden Road, and the Myopia School, Exmouth Street, Hampstead Road, N. W.**
10 A.M.	Discussion on "Eyesight in Connection with Education." To be opened by Messrs. James Kerr, W. G. Sym, and N. B. Harman. The following have also signified their intention of taking part: Messrs. T. Harrison Butler, J. H. Fisher, R. B. Hird, Percival J. Hay, A. L. Whitehead, and L. Paton.
Afternoon.	
3.30 P.M.	**Visit to the Wellcome Museum, 54, Wigmore Street, W. 1.**
8.30 P.M.	Papers.

SATURDAY, MAY 3d

MORNING.	**At the Central London Ophthalmic Hospital, Judd Street, St. Pancras.**
10 A.M.	Clinical Meeting. Members are invited to send cases, and beds will be provided in the Hospital by the Staff as far as possible for those coming from the country.

Members desirous of reading Papers, showing Cases, or taking part in the Discussions are requested to communicate as soon as possible with Mr. M. S. MAYOU, 59, Harley Street, London, W. 1.

Papers and Communications, subject to the judgment of the Council, will be printed in full in the "Transactions."

Under the By-laws readers of Papers must not exceed twenty minutes, subsequent speakers ten minutes. The openers of the Discussions are allowed twenty minutes.

All Communicatious must be typewritten.

A Museum will be held at the Royal Society of Medicine with a Special Exhibition of Optical Glass and Glass Eyes. Members wishing to exhibit Drawings, Specimens, or Instruments should communicate with Mr. R. R. JAMES, 6, Lower Berkeley Street, London, W. 1.

M. S. MAYOU } *Hon. Secs.*
R. R. JAMES

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By JOHN M. WHEELER, M.D., SECRETARY.

MONDAY EVENING, NOVEMBER 18, 1918. MARTIN COHEN, M.D., CHAIRMAN.

Dr. JOHN R. SHANNON presented a patient, age 9 years, who had had **congenital dislocation of both lenses.** The left lens was removed a year ago by Dr. Webster, and the result was good although there was some membrane in the pupil, and the pupil was irregular in shape.

Dr. Shannon made four attempts to needle the right lens, but obtained no result, the lens continuing perfectly transparent, and did not swell. The zonule was so tenuous that the lens was frequently found in the anterior chamber, from which it was extracted after preparation by contracting the pupil with eserine behind the lens. Keratome incision was then made, after enlarging with scissors, and the lens drawn out with a sharp Tyrrell hook. The boy made an uninterrupted recovery.

In the discussion of Dr. Shannon's case Dr. LAMBERT reported the cases which he had operated on—in all six eyes—the operation being repeated needling. The result in all of these cases was eminently satisfactory. Vision in one case being $\frac{20}{30}$ O. U.; another case $\frac{20}{30}$ and $\frac{20}{40}$; and $\frac{20}{40}$ in the third patient.

Dr. KNAPP said that he had operated on a little girl 3 years old in whom the lens was caught in the pupil and partly dislocated into the anterior chamber. The patient had symptoms of glaucoma and a linear extraction was performed with success. The lens was almost globular in shape. In the other eye the iris is tremulous. There was no history of traumatism.

Dr. WEEKS was inclined to think that the dislocation in Dr. Knapp's case was traumatic. He said that he knew of no case on record of congenital dislocated lens in only one eye.

Dr. R. G. REESE presented a case of **restoration of both lids with Wolff graft.** The patient was a man, age 35, with cicatricial ectropion of both lids. All scar tissue was excised and the lids sutured together by Hunter's method. The denuded area was covered with a Wolff graft from the arm. The result was very satisfactory and cosmetically better than the other eye, which was similarly affected and had been operated upon with a pedunculated flap from the forehead.

Dr. JOHN E. WEEKS reported two cases of **homonymous quadrant defects of the fields of vision.**

Case I. E. F. A. was seen on June 14, 1917, with an alternating divergent strabismus of approximately 35 degrees and a vertical error of 1½ degrees. There was no annoyance from diplopia. Vision of $\frac{20}{20}$ in each eye. Patient suffered from facial paralysis eight months previously, traces of which remain. There was a history of intraocular hemorrhage in the right eye one year ago, which cleared rapidly, and a hemorrhage in the left eye six weeks ago. Remnants of hemorrhage in the left eye were present in the upper outer quadrant of the fundus; optic disks and fundi, other than as noted, in good condition, except that there was a moderate degree of arteriosclerosis. Blood-pressure 180 systole. Fields of vision normal, except for a relative scotoma in the inferonasal quadrant of the left eye corresponding with the lesion in the fundus of that eye.

On September 14, 1918, vision was $\frac{20}{20}-$. The exophoria of 35 degrees was converted into an esophoria of ½ degree. There was no vertical error. Ten days before the patient had had an attack affecting his speech and his vision. He remained at home for a week, then gradually resumed his former habits of life. On measuring the fields of vision an absolute scotoma was found in the right inferior quadrant of both fields with a relative defect extending through a sector of about 30 degrees above the horizontal plane in the upper right quadrant of both fields.

The fields have not changed since first observed. The diagnosis in that case is a subcortical lesion, either a thrombus or hemorrhage affecting the optic radiations on the left side in their dorsal aspect, almost entirely, the lesion being located quite close to the cortical visual area.

Case II. H. P. B. was seen on August 8, 1918, stating that six months ago he had had an apoplectic stroke which produced a disturbance of vision, amnesia, and some amnesic aphasia. There was no agraphia, no facial paralysis, no hemiplegia. An incipient cataract reduced the vision to $\frac{20}{30}$—in the right eye and $\frac{20}{200}$—in the left eye. Blood-pressure 120 systole. Arteriosclerosis, quite marked in the retinal vessels. Very slight changes at the maculæ. The fields of vision showed a defect in the upper right quadrant of both fields, not reaching to the center and shading off gradually toward the periphery below the horizon. On November 14, 1918, the fields of vision were unchanged.

The diagnosis in this case is a subcortical lesion on the left side affecting the optic radiations, particularly in their lower aspect, not involving the macular bundle of fibers, but extending into and affecting a portion of the fibers in the upper part of the bundle, the lesion being further removed from the cortical visual area than in the first case. The history in this case points to hemorrhage.

Dr. LESZYNSKY said that the opportunity to present a report of two cases showing a homonymous quadrant defect was unusual, as such cases are not common. The cerebral localization of the lesion in the optic tract is entirely dependent upon the associated symptoms indicating involvement of other tracts or centers. It is probable that in one of the cases there had been a small hemorrhage in the occipital lobe affecting either the optic radiations or the cuneus, thus producing a homonymous hemianopsia, and that the present quadrantic defect remained, after restitution of function in the other quadrant of the hemianopic field.

An analogous condition is not uncommon in cerebral hemorrhage into the internal capsule. The resulting hemiplegia may be complete at first, but within a few hours or days recovery of the lower extremity takes place, the upper extremity remaining permanently paralyzed. This is due to the accompanying cerebral œdema, which by pressure has temporarily interrupted the conductivity of the fiber tract to the leg, while the continuity of the path to the arm has been destroyed.

Dr. L. W. Crigler reported a case of **late infection following trephining for buphthalmos.** Lillie M., age 20; since infancy the right eye has been buphthalmic. There was a gradual increase in the size of the eye associated with increased tension and periodic attacks of pain until three years ago when a trephining was done by Dr. Wootton. Subsequent to the operation, the eye although totally blind was free from pain and increased tension. On September 23d last, the eye suddenly became inflamed. Two days later she presented herself at the hospital. On examination a yellowish white subconjunctival exudate, occupying the site of the trephine hole, was seen. The ocular conjunctiva as well as the deep ciliary vessels were very much engorged. The conjunctiva was œdematous and the upper lid was somewhat swollen. Hypopyon of moderate degree was present. There was no abrasion of the cornea. The hypopyon seemed to have been the direct result of the inflammation extending through the trephine hole, as there was a distinct line of exudation from the trephine opening to the bottom of the anterior chamber. Enucleation was advised and the eyeball removed one week from onset of inflammation.

The specimen shows, aside from the exudate in the anterior chamber, a mass of exudation in the anterior part of the vitreous which is probably from the ciliary body. The character of the infection was not determined. It is possible that it may not have been so virulent as to have destroyed the eye, but inasmuch as the inflammatory symptoms were not subsiding, enucleation seemed indicated.

Dr. Crigler presented a macroscopic specimen of an eye showing **a mass of subretinal exudate.** He had observed the eye before removal from the time vision first became affected until secondary glaucoma made enucleation necessary. On two different occasions the case had been shown to the section. Previous to the onset of secondary glaucoma the retina could be seen to be totally detached and this complication was anticipated. The ophthalmoscopic picture was typical of that type of retinitis described by Coates as "Retinitis Exudativa" and Hippel as "Angiomatosis Retinæ." In none of the reported cases has the exudate been so extensive as in this case. The disease is rare and the cause unknown but when the picture is once seen and carefully studied it should not be confounded with any other. A histologic specimen will be presented at another meeting.

Dr. Arnold Knapp presented a patient with a **quiescent foreign body in the retina of five months' standing.** F. R., aged 44, was seen November 11, 1918, on account of poor sight in the left eye. He stated that while cutting stone, something struck the left eye in July. He was treated at an eye hospital and nothing much was found wrong. Has had no further trouble with the eye, except that the sight is dim. To-day V. O. S. $\frac{15}{200}$. There is a linear wound in the center of the cornea and also of the anterior capsule of the lens, directly underneath. The rest of the lens is clear, except for a radiating opacity in the posterior cortex. This was suggestive of a penetrating injury, and upon examining the eyeground carefully, a very distinct foreign body could be seen in the macular region in the retina. Repeated attempts with a magnet have failed to dislodge the foreign particle which is believed to be firmly wedged in the sclera. The eye is free from irritation and does not present any signs of siderosis.

In connection with Dr. Knapp's case of foreign body in the globe Dr. Lambert reported a similar one which he now has under observation and which he expected to present at the meeting. The injury occurred about six months ago. The wound of entrance cannot be found; the media are perfectly clear; a foreign body can be distinctly seen projecting from the choroid into the vitreous. There is an atrophic area surrounding the location of the foreign body—otherwise the fundus seems fairly normal, and there is no evidence of siderosis. The patient has a high degree of compound hyperopic astigmatism, and with the correction has $\frac{20}{200}$ vision. The propriety of removing the foreign body is being considered.

In discussing these cases Dr. Weeks suggests an X-ray examination, and the application of magnetic force near the equator to dislocate the foreign body if possible and then it could be drawn forward. If it cannot be dislocated Dr. Weeks would leave it alone and watch for siderosis and contraction of the field.

Dr. Ellice M. Alger presented an **instrument to assist in detection of malingerers.** There are two distinct types of test for malingering; one, and by far the most valuable, which aims to reveal the exact vision in each eye; and the other, very much less important, which is intended chiefly to impugn the honesty and credibility of the witness. For instance, the various diplopia tests with candles are intended to show that a man who claims blindness in one eye is not coming into court with clean hands, but even in civil practice they do not exclude a functionally useless eye, while in military practice they are of no practical value at all. Of much more importance are the relatively few tests which indicate a definite amount of vision in each eye, most of which unfortunately are restricted to near vision and are therefore of no military value and of lessened civil use. The common element in all these tests is that they persuade the malingerer that he is seeing with one eye while he is really using the other.

Dr. Alger's device consists of two short parallel cylinders (four inches by one and one half) arranged opera-glass fashion. The distal end of each is closed by a revolving cap, which contains a small aperture (6*mm*), displaced slightly from the center. The patient looks through the instrument as he would a field glass, with both eyes open, at two ordinary test charts twenty feet away and about two feet apart. When the caps are so rotated that the apertures are approximately the same distance apart as the patient's pupils, a *homonymous diplopia* is caused, the right card being visible to the right eye and the left to the left eye.

When the openings are arranged so that their interval is slightly less than the interpupillary distance, both eyes can converge slightly and focus on the same chart, giving real *binocular vision.*

When the openings are approximated still more so that their interval is considerably less than the interpupillary distance, the right eye falls on the left card and the left eye on the right, causing a *crossed diplopia* while the patient, as he looks from one card to the other, has the sensation of using the right eye when he is really using the left, and vice versa.

This impression is heightened by the fact that the apertures are "crossed" so that a card placed over what seems to be the right hole actually blocks the left eye.

If two identical charts are used many patients will fuse them, just as with a weak prism, and see only one card. If extra letters are interpolated on each card, the malingerer will often read them all as though they were on the same card, thus proving binocular vision.

Dr. Martin Cohen presented a **device for examining aviators for distant stereoscopic vision** (published in this issue).

In the discussion Capt. Harvey J. Howard said: "The piece of apparatus shown to-night by Dr. Cohen is to me of unusual interest because my problem for the past month at the Medical Research Laboratories has been 'depth perception.' We have also concluded that it would be of advantage to have a stereoscope which could be used at a distance of six meters and over. To this end I have constructed a modified form of the distance stereoscope proposed by Dr. Brooksbank James in the *Lancet*, June 20, 1908.

"The apparatus consists of three sides of a box, the front, back, and bottom, with a rectangular window in the front wall through which two vertically placed rods or wooden dowels are viewed at varying degrees of depth differences and upon which artificial light is so cast that the illumination of the two rods is equal. In brief, the effort is made to rule out all the criteria (which in nature so often help us to rightly judge size and distance) other than the one of the stereoscopic parallax which is obtained only through employing binocular vision. The relative value of accommodation and convergence, about which there is no consistent agreement, is for all practical purposes disregarded in this experiment.

"James, starting from the basis that normal individuals perceive distinctly the $\frac{6}{6}$ Snellen type, which at 6 meters subtends a visual angle of 5′, and its individual components an angle of 1′, concluded that the parallax angle for normal individuals also should be 1′. From mathematical calculation he found that such an angle required a depth difference of 180*mm* when the nearer object was 6 meters distant.

"The results of our experiments thus far have shown that James's estimate was far too large, for we have found that normal individuals are able to perceive a depth difference of 30*mm*, *i.e.* a parallax angle of only 10″ instead of 60″.

"For field work we are now constructing an apparatus which may be used at 100 meters or so. It consists of a number of white painted semaphores of different sizes which are viewed over the top of a screen, the background being rising ground.

"The whole subject of stereoscopic vision is of great interest to us at present because of the generally accepted view that aviators must possess this power with at least normal facility. It is significant that in summing up the causes of the 'crashes' that have occurred in America at the various flying fields, the excuse most often given was that the flier 'misjudged the distance' in the act of landing."

Dr. ARNOLD KNAPP presented a **microscopical specimen of carcinoma of the lacrimal gland** (appears in this issue).

Dr. R. G. REESE reported a case of **tumor of the orbit.** A woman, age 37, had gradually increasing exophthalmos for three years. Macroscopic specimen presented showed the tumor had invaded the orbit and surrounded the upper and outer side of the globe. Microscopic section showed adenocarcinoma of the lacrimal gland.

BRITISH REPORT ON STANDARD ILLUMINATION OF TEST TYPES.[1]

(*With one illustration in the text.*)

THE effect upon visual acuity of variations in the illumination of test objects has been the subject of a series of careful investigations since the time of Tobias Mayer (1754). Two chief facts emerge from these researches: (1) that there is a rapid rise in acuity as the illumination is increased from zero up to about two foot candles[1]; (2) that above two or three foot candles there is scarcely any appreciable rise in acuity. The results obtained by different observers are not entirely concordant, the discrepancies being attributable to variations in the test object, contrast, size of pupil, etc. So far as the testing of visual acuity for clinical purposes is concerned, it appears to be sufficiently accurate to regard the results obtained with an illumination of three foot candles or more as valid and comparable under the ordinary conditions of clinical testing.

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[1] Report of a committee to determine standards of illumination for Snellen's test types of distant vision. This committee consists of the following members who were appointed by the Council of British Ophthalmologists, representing the Ophthalmological Society of the United Kingdom, the Section of Ophthalmology of the Royal Society of Medicine, and the Oxford Ophthalmological Congress: Sir George Berry (Chairman), Sir Richard Glazebrook, C.B., F.R.S. (Director of the National Physical Laboratory), Mr. C. C. Paterson, O.B.E. (National Physical Laboratory), Mr. Leon Gaster (Secretary of the Society of Illuminating Engineers), Mr. J. Herbert Fisher, Col. J. Herbert Parsons, Mr. A. B. Cridland, and Mr. W. H. MacMullen, O.B.E. (Secretary).

[2] One foot candle is the illumination received from a source of one candle power falling perpendicularly on a surface at a distance of one foot from the source.

There is, however, no doubt that this minimum is by no means always ensured under the actual conditions in which the testing of candidates for military or other public services occurs. Apart from the fact, which should be borne in mind, that the test types often do not conform to Snellen's criteria, they are frequently dirty, thus diminishing contrast, are varnished, thus giving rise to disturbing direct reflection of light, and are viewed under very great variations of daylight, in rooms which are often ill-suited for the purpose.

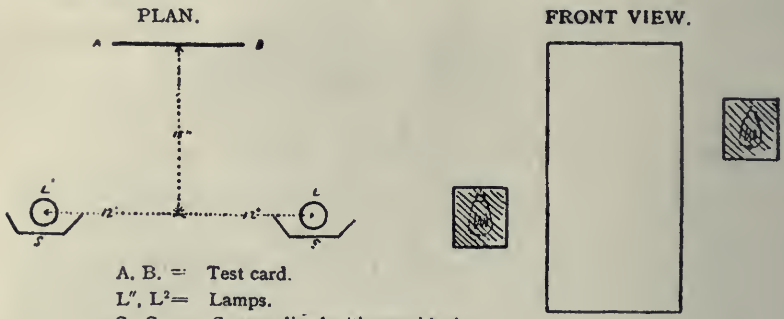
It is possible to lay down precise and simple rules for the efficient illumination of test types, and we see no reason why these rules should not be generally adopted. For the public services it is in our opinion unfair to the candidates and detrimental to the services themselves that the examinations should take place under unsatisfactory, and often hurriedly improvised, conditions. The testing of visual capacity is now an essential part of the physical examination of candidates for a large number of the public services, such as the Navy, the Army, the Mercantile Marine, the Indian Civil Service, and so on. We are of opinion that these tests should be conducted under approved conditions, and that this object would be best attained if the examinations were held at properly equipped centers.

We fully recognize that variations of visual acuity arise from many causes other than the actual illumination of the test types, such as the condition of retinal adaptation, contrast between the test object and its background, the size of the pupil, lateral illumination, and so on. We think, however, that these effects can be minimized sufficiently for practical clinical purposes if the testing takes place in a moderately well illuminated room, with the test types efficiently lighted, and with the careful elimination of any glaring lights or bright objects from the candidate's field of vision.

We consider that the requirements are sufficiently well-satisfied by the following means:

Two ordinary 20-watt tungsten lamps with straight filaments are fixed vertically fifteen inches in front of the plane of the test card, one on each side, at a horizontal distance of twelve inches from the vertical plane normal to and bisecting the card. One lamp is placed higher than the other, one being opposite the junction of the upper and middle thirds of the card, the other opposite the junction of the middle and lower thirds. Opaque non-reflecting screens are fitted, so as to prevent direct light from the lamps reaching the candidate's eyes.

The accompanying diagrams illustrate the arrangement recommended.



A. B. = Test card.
L″, L^2= Lamps.
S, S. = Screens lined with matt black.

This method ensures:

(1) Sufficient illumination. With new lamps the illumination on the test types will be of the order of ten foot candles. The ordinary variations of current, deterioration of lamps, and the darkening of the test card with age will not reduce the brightness of the test card so illuminated to a value less than that of a perfectly white surface receiving an illumination of three foot candles.

(2) Sufficient uniformity of illumination. Whilst we are aware that the same result can be achieved by the employment of properly designed and carefully placed reflectors we have had to recognize in making these proposals that the testing of visual acuity must often be carried out in circumstances which do not admit of the use of special lighting arrangements, requiring technical skill in their installation or upkeep. We have, therefore, endeavored to prescribe a method of ensuring the necessary illumination which is simple to erect, is not liable to become deranged by subsequent treatment, and which enables ordinary lamps on the market to be employed.

Where electric light is not available a similar arrangement can be installed, using other illuminants (see appendix).

Daylight Illumination.—There is no theoretical objection to the use of diffuse daylight so long as the illumination on the test types is adequate, *i. e.*, does not fall below three foot candles. In cases of doubt, it would be necessary to apply tests requiring the skilled use of some form of photometer. We are therefore of opinion that, in order to secure uniformity and comparable results, artificial illumination should in general be used, and invariably in testing for the public services.

We therefore make the following recommendations:

I. *The Test Types.*—The test types shall be of the dimensions laid down by Snellen, and printed on a matt white surface.

II. *Illumination.*—

a. The minimum illumination on the test card shall be such that its brightness shall be equivalent to that of a new card illuminated to at least three foot candles;

b. The illumination of the test types shall be as uniform as possible;

c. Artificial illumination shall be used in preference to daylight;

d. The testing room shall be moderately illuminated, and care shall be taken that there are no glaring lights or bright objects in the candidate's field of vision;

e. Extreme contrast between the illuminated test card and the background shall be avoided.

III. *Method of Lighting.*—

a. The method of lighting described in this report shall be in general adopted;

b. This method shall be made compulsory for sight testing in all public services.

APPENDIX.—ILLUMINATION OF TEST TYPES BY GAS OR OIL LAMPS.

Gas Lighting.—Two "medium" inverted incandescent burners, consuming 2½–2¾ cub. ft. of gas per hour, are fixed 2½ ft. in front of the test card, one on each side, at a horizontal distance of 12 inches from the vertical plane, normal to and bisecting the card. One burner should be higher than the other, one being opposite the junction of the upper and middle thirds of the card, the other opposite the junction of the middle and lower thirds. Burners should be equipped with clear glass globes, and care should be taken to ensure, by regular maintenance, that mantles and burners are kept in good order and in clean condition. Opaque non-reflecting screens are fitted, so as to prevent direct light from the burners reaching the candidate's eyes.

Oil Lighting.—Two standard "Duplex" oil lamps, each having a double straight wick, 1 inch in width, and a chimney 10½ inches in length, are fixed 2 ft. in front of the test card, one on each side, at a horizontal distance of 12 inches from the vertical plane, normal to and bisecting the card. One lamp should be higher than the other; one being opposite the junction of the upper and middle thirds of the card, the other opposite the junction of the middle and lower thirds. The wick should be turned up as high as is possible without smoking, and the face of the wick should be turned towards the card. The distance from top of wick to level of oil in reservoir should not exceed 5 inches. The lamp should be lighted twenty minutes before the test, so as to ensure steady conditions of burning. Opaque non-reflecting screens are fitted, so as to prevent direct light from the lamps reaching the candidate's eyes.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY FOR THE FIRST, SECOND, AND THIRD QUARTERS, 1918.

By H. Koellner, Berlin; W. Krauss, Marburg; R. Kümmell, Erlangen; W. Loehlein, Greifswald; H. Meyer, Brandenburg; W. Nicolai, Berlin; H. Pagenstecher, Strassburg; K. Wessely, Würzburg; and M. Wolfrum, Leipsic; with the Assistance of Drs. Alling, New Haven; Calderaro, Rome; Causé, Mayence; Curran, Kansas City; Danis, Brussels; Gilbert, Munich; Groenholm, Helsingfors; v. Poppen, Petrograd; Treutler, Dresden; and Visser, Amsterdam.

Edited by Matthias Lanckton Foster, M.D., F.A.C.S.,
New Rochelle, N. Y.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

1. Danis, M. **War and night blindness.** *American Journal of Ophthalmology*, July, 1918.
2. Duverger. **Two months of ophthalmological practice on urgent cases in evacuation hospitals.** *Annales d'oculistique*, cliv., 10.
3. Kalt, M. **Multiple exostoses on the skull of a boy.** *Annales d'oculistique*, cliv., 12.
4. Weekers, L. **Organization of the ophthalmological service in the Belgian army.** *Annales d'oculistique*, cliv., 10.

Danis (1, **War and night blindness**) has studied this defect among Belgian soldiers. He finds it a well-established affection. The night life of the soldier develops a number of those who have congenital hemeralopia but errors of refraction and cloudy media may be the cause. It seems probable, however, that the strenuous activities incident to the war with its mental and physical strain cause night blindness by disturbing the circulation in the choriocapillaris and interfering with retinal adaptation.

Alling.

KALT'S (3, **Multiple exostoses on the skull of a boy**) patient had a number of exostoses of the orbital margins, inferior maxilla, frontal and parietal bones, etc. The author does not give the other clinical features and the serological findings.

SCHOENBERG.

WEEKERS (4, **Organization of the ophthalmological service in the Belgian army**) emphasizes the importance of having an ample supply of ophthalmologists attached to the Medical Corps.

SCHOENBERG.

DUVERGER (2, **Two months of ophthalmological practice on urgent cases in an evacuation hospital**) says that there is a very great demand for a well-trained ophthalmologist at an evacuation hospital. In one single day, following an attack, he has seen eleven cases of perforating wounds of the eyeball and thirty wounds of the orbits and lids. Such cases need immediate and proper attention by a skilled ophthalmologist. He classifies the eye cases in two groups: (1) Injuries of the eyeballs; (2) injuries of the tissues surrounding the eyeballs. One of the most important kind of cases belonging to the second group is that of fractures of the base of the skull with subconjunctival hemorrhage and obscure clinical symptoms. The ophthalmologist should be on the lookout for such cases; a lumbar puncture will establish the diagnosis and prevent the removal of such a case to some distant place and the exposing of the wounded to undue strain.

The wounds of the orbits and lids with intact eyeballs are usually benign. They do not usually become infected. Wounds of the lids are to be treated along the usual lines: excision of the fringes of tissue, approximating and suturing the lips of the wounds.

The wounds of the conjunctiva of the fornix and of the eyeball have to be carefully searched for the presence of a foreign body in the orbit or a tear in the sclera. After the removal of the foreign body the tear is sutured and symblepharon prevented by sliding a flap of conjunctiva prepared from the immediate vicinity.

Patients with intraorbital conditions and with characteristic symptoms (exophthalmus, chemosis, œdema of the lids, disturbances of motility of the eyeball, diminution of vision), present two main problems for elucidation: (1) The presence of a foreign body; (2) the fracture of one of the walls of the orbit. The superior wall is the most important, on account of its relations to the cranial fossa and brain.

If the X-ray study of the case reveals no foreign body the treatment is conservative. If there is a foreign body, as small as a pea, the expectant policy is yet to be preferred. Larger foreign bodies are to be immediately extracted, *not* through the conjunctival wound, which when enlarged and bruised by manipulations will eventually leave a bad scar, but through an incision in the skin of the lid on a line corresponding to the orbital margin. A good incision for a free access to the orbit is on a vertical line starting from the outer extremity of the eyebrow extending downwards one centimeter on the outside of the external commissure and curving towards the nose for about two centimeters along the lower orbital margin. This incision has the double advantage of avoiding the opening of the conjunctival sac and of sparing the facial nerve-fibers going to the orbicularis. The orbital periosteum is then easily separated up to the tip of the orbit and the finger introduced deep into the wound can feel the foreign body. If this fails the author advises the use of the fluoroscope.

Regarding perforating injuries of the eyeball the author recommends an optimistic policy as far as enucleation is concerned. He performed only four enucleations and six exenterations in one hundred cases of intraocular foreign bodies. The advantages of an immediate diagnosis and extraction of intraocular foreign bodies being universally agreed upon, the author recommends the installation of an X-ray department and electro-magnet in each evacuation hospital.

SCHOENBERG.

II.—THE EYE IN ITS RELATIONS TO GENERAL DISEASE.

5. DOR, L. **Optic neuritis of dental origin.** *Clinique ophtalmologique*, viii., 9.

6. DOR, L. **Thrombosis of retinal veins due to dental infection.** *Ibid.*

7. MARIN, M. **Papillary ectasis and lumbar puncture.** *La clinique ophtalmologique*, viii., 7.

8. TEAL, F. F. **A study of the eye in dementia præcox.** *American Journal of Ophthalmology*, March, 1918.

9. Tyson, H. H. **Report of a case of bilateral inferior hemianopsia.** *American Journal of Ophthalmology*, January, 1918.

10. Yudkin, A. M. **Leprosy with especial reference to ophthalmologic findings.** *Ibid.*, May, 1918.

Dor (5 and 6, **Optic neuritis and thrombosis of the retinal veins of dental origin**) reports in these two papers the cases of three patients. Two of them had optic neuritis, the other a thrombosis of the retinal veins. He ascribes the condition in all three to a dental infection.

Schoenberg.

Marin (7, **Papillary ectasis and lumbar puncture**) reports three cases of bilateral papillœdema, with amaurosis probably due to tubercular meningitis, in which vision returned and the œdema of the disks disappeared after a few lumbar punctures. He believes that the most frequent cause of papillœdema is tubercular meningitis and that the repeated extraction of spinal fluid acts favorably by relieving the intracranial pressure, reëstablishing a normal circulation and removing toxins.

Schoenberg.

Tyson (9, **Bilateral inferior hemianopsia**) examined a woman with albuminuric retinitis who had become suddenly blind four days before. He found swelling of the disk about 3 D. When last seen, nine years later, the nerves were white but vision had returned to R. $\frac{20}{40}$; L. $\frac{20}{30}$. The visual fields were contracted below to within 3° of the fixation point in each eye. The diagnosis was œdema of the third and fourth ventricles (serous meningitis) complicating nephritis and the inferior hemianopsia by a lesion of the upper surface of the chiasm. The fact that the patient had lived so many years is also of interest.

Alling.

Teal (8, **The eye in dementia præcox**) after reviewing the literature relates his own observations in the examination of fifty-three cases of dementia præcox as well as of thirteen cases of maniacal insanity. The most constant feature was dilated and tortuous retinal veins with contracted arteries. The disk at times was normal but in some cases there was more or less hyperæmia. He saw a few cases which showed the condition described by Tyson and Thomas, that is, the nasal side of the nerve congested and the temporal side pale. When it was possible to take the fields they often showed contraction for form and color and interlacing of the color limits. In all the pupils were a little larger than normal and he noted absence of small normal iris movements. The sensory reflex was absent in 70%. There seems to be no fundus change pathognomonic for this condition but the pupil changes are quite constant.

ALLING.

The eye is very commonly affected in leprosy. The lids show either anæsthesia or nodules and the lashes are lost. The conjunctiva is often infiltrated with leprous nodules, but the sclerocorneal junction is the site of predilection, pale grayish-yellow elevations being the characteristic lesion. The cornea is anæsthetic and several forms of keratitis are found. The iris and ciliary body are occasionally involved and the ophthalmoscope may show white spots and disturbed pigmentation in the later stages. YUDKIN (10, **Leprosy with especial reference to ophthalmologic findings**) had the opportunity of studying two cases of the anæsthetic type in one of which changes in the lids, as well as sclerocorneal and corneal lesions were observed while the other had only nodules and anæsthesia of the lids. The acid-fast bacillus of Hansen was isolated in both cases.

ALLING.

III.—PATHOLOGY AND BACTERIOLOGY.

11. GREENSPON, E. A. **A pathogenic bacillus subtilis isolated from the eye.** *American Journal of Ophthalmology*, May, 1918.
12. BONNEFON, G., and FROMAGET, H. **Researches on histological evolution of aseptic scleral resections.** *Annales d'oculistique*, cliv., 9.

GREENSPON'S (11, **Pathogenic bacillus subtilis isolated from the eye**) communication is based upon the examination of two cases of panophthalmitis following cataract extraction. Bacteriologic studies of the saline solution used in irrigation proved that it contained the same organism which was recovered from the infected eyes. The tubing and glass funnel were also tested and were likewise infected. A culture of the bacillus was injected into the anterior chamber of a rabbit's eye and produced a violent panophthalmitis. As the bacillus subtilis obtained from hay infusion was not pathogenic, it seems therefore that only certain races of the organism are capable of producing suppuration.

ALLING.

BONNEFON and FROMAGET (12, **Researches on histological evolution of aseptic scleral resections**) have made a histological study of the wounds after scleral resections in rabbits with the object of possibly solving the question: Why a sclerectomy reduces the ocular tension in some glaucomatous eyes and fails in others? Their researches and a study of the reports on microscopic examinations of sclerectomized glaucomatous human eyes lead them to the following conclusions: (1) The loss of substance in the sclera—like that in the cornea—is cicatrized in the same manner. The fibrinous clot begins to organize about the third day and is gradually replaced by fibro-plastic cells. After two months the wound is completely closed by a more dense but less regular tissue. (2) This regeneration can be retarded or prevented only by the interposition of a heterogeneous tissue like uvea or conjunctiva. If the prolapsed tissue is impermeable (the uvea), the tension remains unchanged; but if it is permeable (the conjunctiva), the tension is lowered. (3) In no case did the wound remain open (fistulization) when there was no prolapse of tissue between its lips. The anatomo-pathological studies of human eyes, published mostly by Meller, agree with these experimental findings. They show that the scleral wound, even in old patients, closes up very rapidly and completely, if there is no prolapse of iris or conjunctiva.

SCHOENBERG.

IV.—INSTRUMENTS AND REMEDIES.

13. BAILLART, P. **The blood pressure in the branches of the central retinal artery; a new technique for its determination.** *Annales d'oculistique*, cliv., 11.

14. GROS, H. **Thermocautery handle.** *Clinique ophtalmologique*, viii., 8.

15. RICHARD, P. **Treatment of syphilis with galyl.** *Ibid.*, viii., 8.

GROS (14, **Thermocautery handle**) has devised a thermocautery handle consisting of two tubes of brass separated by a layer of asbestos, for which he claims the advantage of remaining cold for from ten to fifteen minutes. The picture and description of this handle lack in clearness.

SCHOENBERG.

Richard (15, **Treatment of syphilis with galyl**) confirms the favorable findings of a number of other authors.

Schoenberg.

Baillart (13, **The blood pressure in the branches of the central retinal artery; a new technique for its determination**) says that the study of the artificially induced pulsations of the retinal arteries by pressure exerted upon the eyeball brings out two important facts: (1) The amount of compression exerted upon the eyeball to bring out the arterial pulse is equal to the diastolic blood pressure in the retinal arteries; (2) if the compression is continued until the pulsation stops entirely and then gradually released, until the arterial pulse reappears, the amount of compression at that instant is equal to the systolic blood pressure in the retinal arteries. The author has succeeded in constructing a small dynamometer which registers in grammes the pressure exerted. With this handy little instrument applied on the eyeball, a few millimeters above and temporally from the cornea, he presses on the eyeball (while watching the fundus by direct electric ophthalmoscopy) until the two phenomena of pulsation appear. The number of grammes indicated on the dynamometer translated into Hg. *mm* gives the systolic and diastolic blood pressure in the retinal arteries. He studied this subject in normal eyes and found that the diastolic pressure is about 25*mm* and the systolic pressure is 50*mm*. Whenever it is necessary to exert a pressure higher than 35 grammes to bring out the arterial pulsation and 80 grammes to stop it entirely there is a hypertension of the retinal arteries. In glaucomatous eyes, where the intraocular pressure is raised it was found that the blood pressure is also automatically raised and whenever the ocular tension is reduced by myotics or surgically the blood pressure in the retinal vessels is also diminished. This work, although at its very beginning, promises a series of fruitful informations on ocular physiology and pathology. Schoenberg.

V.—GENERAL TREATMENT AND DIAGNOSIS.

16. Abadie, Ch. **Continuous and prolonged mercurial treatment for grave forms of ocular syphilis.** *Annales d'oculistique,* cliv., 12.

17. Domec, Th. **The treatment of various ocular affections by hypodermic or intramuscular injections of sterile milk.** *Clinique ophtalmologique,* viii., 9.

18. Loeb, C. **Deep X-ray therapy in the treatment of tumors of the hypophysis.** *American Journal of Ophthalmology*, June, 1918.

19. Nicolle and Blaizot. **Preventive and curative bacteriotherapeutics by the use of atoxic and stabilized vaccines.** *Clinique ophtalmologique*, viii., 9.

20. Smith, A. S. **Importance of temperature curve for the early recognition of intraocular tuberculosis.** *American Journal of Ophthalmology*, February, 1918.

21. Tillot, E. **Ocular affections treated with the waters of Saint-Christau (Pyrénées Orientales).** *Clinique ophtalmologique*, viii., 8.

Abadie (16, **Continuous and prolonged mercurial treatment for grave forms of ocular syphilis**) is convinced that syphilitic optic nerve lesions and chorioretinitis can be arrested and even improved a great deal by intravenous injections of one centigramme mercury cyanide, every day or every other day for a long period of time. Improvement should not be expected during the first ten to twenty injections; results begin to show only after thirty to forty injections. The indication for the cessation of treatment is icterus, which signifies hepatic intolerance. The author has followed this treatment for the past twenty years and has seen cases keeping their vision as long as they received this line of treatment regularly.

Schoenberg.

Domec (17, **The treatment of various ocular affections by hypodermic or intramuscular injections of sterile milk**) has injected sterile milk under the skin or in the muscles of patients with chronic eczematous blepharitis, ulcers of the cornea, iritis, iridochoroiditis, etc., and obtained results far superior to any other methods he had used before for these affections. He recites a number of cases showing how apparently very serious conditions cleared up rapidly and completely after from one to four injections of milk. The dose used was 1*cc* in infants, 2*cc* in children, and 4–5*cc* in adults, administered at intervals of three to eight days apart.

Schoenberg.

Tumors of the hypophysis have from time to time been treated successfully by the X-ray. Loeb (18, **Deep X-ray therapy in the treatment of tumors of the hypophysis**) reports the case of a woman aged 38 who complained of increased weight and severe headaches with partial loss of vision. He found pale optic nerves and incomplete temporal hemianopsia.

The sella turcica was decidedly enlarged. In the treatment the X-ray was applied to parts of the skull which are nearest the hypophysis, an aluminum plate being interposed to cut out the less penetrating rays. Repeated doses were given to the production of an erythema. There were alleviation of the headaches and improvement in the visual fields.

ALLING.

NICOLLE and BLAIZOT (19, **Preventive and curative bacteriotherapeutics by the use of atoxic and stabilized vaccines**) say that microörganisms killed by heat or antiseptics for the preparation of vaccines undergo a gradual lysis in the course of time and their immunizing power is diminishing very rapidly. They have found that a fluoride of sodium solution acts upon the microörganisms in such a manner that, while killing them, it does not destroy their morphology for a considerable time. Thus, the microbes conserve their chemical make-up and are nearer to the living ones than the ordinary vaccines so far as their immunizing properties are concerned. They have succeeded in preparing preventive vaccines against typhoid, cholera, and dysentery and curative vaccines for gonorrhœa, staphylococcic and streptococcic infections, typhoid fever, dysentery, and pertussis. SCHOENBERG.

SMITH (20, **Importance of temperature curve for the early recognition of intraocular tuberculosis**) calls attention to a fact which should be always noted, namely that patients with tuberculous lesions of the fundus commonly have an afternoon rise of temperature of one or two degrees. ALLING.

TILLOT (21, **Ocular affections treated with the waters of Saint-Christau (Pyrénées Orientales)** says he has obtained good results by topical applications of the St. Christau waters in chronic blepharitis, trachoma, corneal opacities, and dacryocystitis. These waters contain iron and copper salts.

SCHOENBERG.

VI.—POISONS.

22. ELLIOT, R. H. **Quinine poisoning; its ocular lesions and visual disturbances.** *American Journal of Ophthalmology*, September, 1918.

23. KERSHNER, W. E. **Optic atrophy due to gassing.** *Ibid.*, March, 1918.

24. ROBINSON, J. M. **The toxic action of emetin on the eye.** *Ibid.*, April, 1918.

ELLIOT'S (22, **Quinine poisoning; its ocular lesions and visual disturbances**) paper is an analytic study of the literature combined with personal experiences. He points out the danger of mistaking the symptoms of quinine poisoning for those of malaria—an error which is frequently made.

ALLING.

KERSHNER (23, **Optic atrophy due to gassing**) reports the case of a soldier who had suffered from a gas attack in France. When he enlisted his left eye was defective with vision about $\frac{20}{50}$. At the time of the gassing he lost consciousness for about three hours and later found his left side nearly paralyzed. His vision was reduced to light perception for seven weeks but gradually improved to R. $\frac{20}{40}$ L. movements. The optic nerves were found atrophic with evidence of previous neuritis. The fields were contracted and the blind spot enlarged.

Whether the neuritis was caused by the effect of the gas upon the vasomotor system, by direct blood changes or through involvement of the sinuses it is not possible to state.

ALLING.

ROBINSON (24, **The toxic action of emetin on the eye**) prescribed homatropine but through a mistake of the druggist emetin was substituted. After about ten hours it produced congestion, smarting lacrymation, and photophobia. The same effect was noted when the drop was put into his own eye. The reviewer has seen a severe conjunctivitis and a small ulcer of the cornea produced by a minute quantity of a substance used by dentists which contains ipecac.

ALLING.

VII.—REFRACTION AND ACCOMMODATION.

25. OGATA, D., and WEYMOUTH, F. W. **Refractive differences in foveal and parafoveal vision.** *American Journal of Ophthalmology*, September, 1918.

26. ZENTMAYER, W. **Apparent accommodation in aphakia.** *Ibid.*, August, 1918.

The experiments outlined by OGATA and WEYMOUTH (25, **Refractive differences in foveal and parafoveal vision**) were suggested by the fact that one of the writers discovered that his refraction was less hypermetropic in a dim light. It was shown that somewhat less than one half of the individuals examined had a difference of refraction from 0.25 D. to 0.5 D. between the foveal and parafoveal vision—always toward less hypermetropia and more myopia. It has been supposed that the enlargement of the pupil under these conditions would account for the varied refraction, but the authors believe that they have excluded this factor and they explain the phenomenon by the fact that the parafoveal region is more sensitive to light and is therefore used in the dark.

The difference in refraction about the macula may be explained anatomically by assuming a slight recession of the retina.

ALLING.

ZENTMAYER (26, **Apparent accommodation in aphakia**) relates the case of a girl 8 years old upon whom he has operated for cataract leaving a small opening in the remaining lens matter and capsule. The vision was good for both distance and near. After enumerating the possible explanations he concludes that the results were obtained by the pin hole effect of the small hole in the pupil which cut out the circles of diffusion.

ALLING.

VIII.—THE MOTOR APPARATUS OF THE EYE.

27. JACOBS, M. W. **Latent nystagmus.** *American Journal of Ophthalmology*, March, 1918.

28. LOEB, C. **Convergent strabismus treated by atropine and glasses, with some cases of heredity strabismus.** *Ibid.*, September, 1918.

29. SCHWENK, P. N. K., and POSEY, W. C. **Contraction of paretic external rectus muscle diminishing when masseters are contracted in act of biting.** *Ibid.*, June, 1918.

30. VAN DER HOEVE, I. **Latent nystagmus.** *Annales d'oculistique*, cliv., 12.

31. ZIMMERMANN, C. **Concomitant movements especially of the upper eyelid with suction.** *American Journal of Ophthalmology*, July, 1918.

JACOBS (27, **Latent nystagmus**) describes the case of a boy who was amblyopic in one eye, had a slight amount of hypermetropia but did not squint. When either eye was covered a marked horizontal nystagmus appeared. A supranuclear tonic association center as well as a clonic center are supposed to exist and the latter is constantly under the control of the former. In these cases it is thought that the control is defective.

ALLING.

Loeb (28, **Convergent strabismus treated by atropine and glasses, with some cases of heredity nystagmus**) presents a tabular report of twenty-nine cases showing the results of non-operative treatment. All but five were corrected or improved. There were twelve families which showed direct heredity, there being thirty-five children, fifteen of whom were affected. Seven families showed indirect heredity with twenty-four children, eight of whom had strabismus. Twelve families showed collateral heredity with forty-eight children and twenty-seven affected.

Collateral heredity therefore seems the most common occurrence.

Alling.

Schwenk and Posey (29, **Contraction of paretic external rectus muscle diminishing when masseters are contracted in act of biting**) relate the interesting case of a man who had a severe injury with probable hemorrhage at the base of the skull and paralysis of the fifth and sixth nerves of the left side. Recovery took place in the fifth but there was total paralysis of the external rectus. When he closes his lower jaw in the act of biting the externus regains part of its activity. The phenomenon is explained on the supposition that some of the regenerating fibers of the trigeminus found their way into the abducens nerve. The anatomical connection between the two nerves would be from the fifth through the optic ganglion, Vidian nerve, Meckel's ganglion, cavernus plexus to the sixth.

Alling.

Van der Hoeve (30, **Latent nystagmus**) reports the observations of six patients with nystagmus appearing only when either of the eyes was screened. He found the condition always bilateral. The acuity of vision is greatly reduced by the nystagmus; in the first patient from $\frac{6}{10}$ to $\frac{8}{60}$; in the third one from $\frac{5}{10}$ to $\frac{1}{10}$; in the fourth one, from $\frac{65}{100}$ to $\frac{13}{100}$; in the fifth case from $\frac{6}{8}$ to $\frac{6}{24}$; in the sixth case from $\frac{6}{8}$ to $\frac{6}{60}$, so that the binocular vision was 7, 5, 5, 3, and 3½ times better than the monocular vision. The internal ear functions were found normal, Wassermann negative, the nervous system sound. In trying to explain the mechanism of latent nystagmus the author advances the following hypothesis: (1) Patients with this anomaly have their centers of associated movements of the eyes in an unstable or labile equilibrium; (2) the left eye sends to these centers an impulse by which there is a tendency to move both eyes to the right, while the right eye sends an impulse to the same centers tending to deviate both eyes to the left.

In normal individuals the state of equilibrium of the centers of associated movements is stable, while in patients with a labile or unstable condition of equilibrium of these centers the mere screening of one eye disturbs the equilibrium of these centers to such a degree that the action of the seeing eye predominates; both eyes deviate to the opposite side. The power of fixation of the seeing eye replaces them in normal position, but the lack of central equilibrium deviates them again. In this manner we observe a continuous movement of the eyes, the result of a struggle between the tendency to fix and the impulse to deviate.

SCHOENBERG.

ZIMMERMANN (31, **Concomitant movements especially of the upper eyelid with suction**) observed a boy baby 8 months old who raised his right upper lid when drinking from a bottle, but this occurred only when he was looking down. The most plausible explanation seems to be that the nerves of the levator arise partly or exclusively from the nucleus of the motor part of the fifth which supplies the muscles of the jaw.

ALLING.

IX.—THE LIDS.

32. DEL MONTE, ALBERTO. **The ætiology and pathogenesis of chalazion. A summary of former researches and new observations.** *Annales d'oculistique*, cliv., 10.

DEL MONTE (32, **The ætiology and pathogenesis of chalazion**) summarizes his studies on the ætiology and pathogenesis of chalazion, published during the last few years in *Archivio di Ottalmologia*. He reaffirms his conviction that chalazion is produced by a protozoa which he has invariably found in the granular tissue of the walls of this little tumor. "The morphology is of unusual complexity and variety." The micro-organism consists of a cortical and nuclear portion and frequently contains hyaline granules. The author did not succeed in growing them on artificial media.

The chalazion commences as a primary lesion on the epithelial lining of a Meibomian gland followed by a reactive proliferation of the surrounding tissue. This constitutes the first stage (of short duration) succeeded by the second stage consisting of an extension of the process to the extraglandular tissue, when the parasite penetrates the tarsus.

SCHOENBERG.

X.—ORBITS, ACCESSORY SINUSES, EXOPHTHALMOS.

33. BEDELL, A. J. **A case of traumatic pulsating exophthalmos.** *American Journal of Ophthalmology*, May, 1918.

34. CAMPBELL, A. C. **Neurofibromatosis of the orbit.** *Ibid.*, August, 1918.

35. CHANCE, B. **A case of cavernous angioma of the orbit.** *Ibid.*, January, 1918. *Transactions American Ophthalmological Society*, 1917.

36. GIFFORD, H. **The treatment of blood cysts of the orbit.** *Ibid.*, September, 1918.

37. ORENDORFF, O. **Successful removal of a bullet imbedded in the orbit ten years.** *Ibid.*, February, 1918.

BEDELL (33, **Traumatic pulsating exophthalmos**) was able to watch his case from the first appearance of diplopia and exopthalmos which followed a blow on the right parietal region. Later the eye showed pulsation and a bruit developed. As the proptosis and ocular paralysis increased ligation of the internal carotid artery was done. The immediate result was a blanching of the fundus and a reduction of the exophthalmos. Although signs of cerebral œdema appeared the patient recovered with slight prominence of the eyeball and atrophy of the optic nerve.

ALLING.

CAMPBELL (34, **Neurofibromatosis of the orbit**) removed two tumors from the upper part of the orbit but was obliged to leave a third which was too deeply seated. The patient had had many operations for similar masses in different parts of the body. He complained of severe pain in the eye which was proptosed and pushed downwards. The nerve was slightly pale and veins a little enlarged but there were normal vision and motility. The operation relieved the pain and part of the exophthalmos but ten months later the eye was becoming more prominent.

ALLING.

CHANCE (35, **Cavernous angioma of the orbit**) operated on a girl of 16 with a soft tumor mass occupying the upper half of the orbit. It was first noticed soon after birth and had grown to a size larger than an English walnut. Pressure on the jugulars increased its volume and in stooping and during excitement it protruded through the palpebral fissure. It was dissected out with some difficulty and was found to be adherent to the upper sclera.

ALLING.

GIFFORD (36, **Treatment of blood cysts of the orbit**) reports two cases in which the eye was pushed forward by an orbital mass which when exposed by removal of part of the outer orbital wall and proved to be cystic and lobulated. A brownish fluid filled the cysts. The cavities were swabbed out with phenol and alcohol. There was complete recovery in both cases. In a third case the orbit was opened in a similar manner and a pyramidal tumor removed. The exterior of the mass was irregular and when cut open proved to consist of connective tissue with pockets containing coagulated blood. In every case of deep-seated orbital tumor of uncertain nature the possibility of its being a blood cyst should not be overlooked.

ALLING.

ORENDORFF (37, **Removal of bullet imbedded in the orbit ten years**) made an incision along the outer margin of the orbit and separated the periosteum from the bone backward toward the apex keeping well in the superior part of the orbit. The .38 caliber bullet was found imbedded in the bone of the upper wall and was extracted with difficulty. Recovery was complete and the violent headaches and mental irritability, from which he had suffered, disappeared.

ALLING.

XI.—THE CONJUNCTIVA.

38. CONNER, R., and BURKHOLDER, C. A. **Pemphigus of the conjunctiva.** *American Journal of Ophthalmology*, August, 1918.

39. DARIER, A. **The value of gonococcic vaccine for purulent ophthalmia in adults.** *Clinique ophtalmologique*, viii., 9.

40. FERNANDEZ, J. S. **Conjunctivitis of the fornix.** *American Journal of Ophthalmology*, August, 1918.

41. KERSHNER, W. E. **Ætiological factors in an epidemic of acute conjunctivitis at Camp Sherman.** *Ibid.*, July, 1918.

42. SANTO FERNANDEZ, J. **Is trachoma curable?** *Annales d'oculistique*, cliv., 9.

43. Shumway, E. A. **Vernal conjunctivitis greatly improved by radium treatment.** *American Journal of Ophthalmology*, June, 1918.

44. Van Schevensteen, A. **Hyaline degeneration of the caruncle and tarsal conjunctiva in an old trachoma patient.** *Annales d'oculistique*, cliv., 10.

Conner and Burkholder (38, **Pemphigus of the conjunctiva**) observed the case of a private in the United States Army who complained of frequent attacks of inflammation in his left eye during nine months preceding. The lower fornix was almost obliterated. While under treatment blebs which lasted about three days appeared on the ocular conjunctiva and left areas of ulceration. No similar lesions showed in the other eye or in other parts of the body. When discharged from the army the eye was completely quiet, but the conjunctiva had a dull and lusterless surface with much shrinking.

Alling.

Darier (39, **Value of gonococcic vaccine for purulent ophthalmia in adults**) reports a case of gonorrheal ophthalmia in an adult which seems to have been rapidly controlled by the use of dmegon, a gonococcal vaccine. Argyrol and irrigations were employed locally as usual.

Schoenberg.

Fernandez (40, **Conjunctivitis of the fornix**) calls attention to a condition of the fornix characterized by non-inflammatory swelling and protrusion due to serous infiltration. It seems to be quite frequent in Cuba and has often been mistaken for trachoma. Blood examinations do not show the patients to be anæmic, but the extreme heat and debility incident to life in the tropics are evidently factors to be considered.

Alling.

Kershner (41, **Ætiological factors in an epidemic of acute conjunctivitis at Camp Sherman**) gives the following results of the bacteriological examination of twelve hundred cases of this disease. Pneumococcus, 37.5%, staphylococcus, 6%; meningococcus 1.5%; Koch-Weeks, 2.5%; Morax-Axenfeld, 3.5%; organisms undetermined, 9%; no organisms, 40%.

Alling.

Santo Fernandez (42, **Is trachoma curable?**) says that his ophthalmological experience of more than forty years teaches him to say that the diagnosis of trachoma cannot be made most of the time unless the disease has progressed far enough to show characteristic complications. He does not believe that trachoma is curable.

SCHOENBERG.

Various reports of the successful treatment of this refractory affection have appeared from time to time in literature. SHUMWAY (43, **Vernal conjunctivitis greatly improved by radium treatment**) adds another marked case in which nearly a complete cure was brought about after six applications. He thinks that 25 to 35*mg* should be used for a period of fifteen minutes at intervals of from two to four weeks. Inflammatory reaction may be prevented by suitable protection of the adjoining parts.

ALLING.

VAN SCHEVENSTEEN (44, **Hyaline degeneration of the caruncle and tarsal conjunctiva in an old trachoma patient**) describes a peculiar lesion that consisted of a flat, cartilaginous swelling, occupying the region of the caruncle and the inner third of the tarsal conjunctiva of both eyelids of the left eye. The removal of this swelling and its microscopic examination revealed a hyaline degeneration of the tissues involved.

SCHOENBERG.

XII.—THE CORNEA.

45. TILLOT, E. **Traumatic ulcerative keratitis, complicated by iritis, successfully treated with dionin.** *La clinique ophtalmologique*, viii., 8.

TILLOT (45, **Traumatic ulcerative keratitis successfully treated with dionin**) reports a case of this nature. The condition was due to an accidental introduction of a small quantity of powder of stanniferous chloride into the conjunctival sac of one eye. The immediate irrigation of the eye did not prevent the development of a violent keratitis and iritis which showed no trace of improvement for twenty-four days, in spite of the faithful treatment with atropine, adrenaline, cocaine, iodoform, and hot applications. Finally instillations of dionin acted like a specific, the cornea and iris cleared up in a few days and the vision improved from counting fingers to normal.

SCHOENBERG.

XIII.—THE IRIS.

46. Bichon, A. **Colloidal sulphur for rheumatic manifestations in the eyes.** *La clinique ophtalmologique*, viii., 7.

47. Feingold, M. **Essential atrophy of the iris.** *American Journal of Ophthalmology*, February, 1918.

48. Shannon, C. E. G. **Two cases of congenital coloboma of iris and choroid.** *Ibid.*, January, 1918. *Transactions American Ophthalmological Society*, 1917.

Bichon (46, **Colloidal sulphur for rheumatic manifestations in the eye**) reports five cases of rheumatic iritis which were treated with atropine, hot applications, and colloidal sulphur injected intravenously or intramuscularly, and is satisfied that the addition of this drug hastened recovery to a considerable degree.

Schoenberg.

Feingold's (47, **Essential atrophy of the iris**) patient, a woman of 37, gave a history of left convergent strabismus and, six months before seen, an attack of severe pain with impaired vision on the left side. The attacks of pain returned and the vision was lost. The pupil was eccentric and irregular. The iris was light brown as was the other eye, but was blurred. There were several black areas in the ciliary region where the details were absent. Some of these areas consisted of a layer of brownish black pigment impervious to light, others were holes.

Tension of the eye was 38*mm*. The eye was enucleated on account of pain. The iris angle was found obliterated and the dark areas observed clinically were seen to be true holes, others to consist of pigment. Blood-vessels were very numerous in the ciliary region but in the sphincter portion were very thin and scanty. In the temporal side of the retina cell-like bodies appeared which were considered to be ganglion cells having undergone degeneration, this view being strengthened by the absence of ganglion cells in the retina affected. The optic nerve showed typical cupping and on the temporal side an area in which the fibers are absent—so-called cavernous degeneration of Schnabel. The conclusions are that there was a congenital defect in the smaller arterial circle and that toxins were set free by destruction of the iris tissue producing changes in the other structures of the eye. Alling.

SHANNON (48, **Congenital coloboma of iris and choroid**) in his report describes two cases associated with microphthalmos and convergent strabismus. Investigation of the family revealed the fact that the father and two sisters were similarly affected as well as a brother and sister of the father. This report confirms the opinion that hereditary influences are potent in the production of the anomaly.

ALLING.

XIV.—THE LENS.

49. BARRAQUER, J. A. **A few indications for phacoerisis.** *La clinique ophtalmologique*, viii., 7.

50. COLIN, A. **The simple extraction of cataract with suture of the corneal flap.** *Annales d'oculistique*, cliv., 8.

51. PAINE, H. S. **Operation for the extraction of lenses fully dislocated into the vitreous.** *American Journal of Ophthalmology*, March, 1918.

BARRAQUER (49, **A few indications for phacoerisis**) recommends the intracapsular extraction of all except the membranous cataracts. He has met no difficulties and has extracted the lens in capsule in a variety of complicated cases, like retinitis pigmentosa, high myopia, iridocyclitis, chorio, retinitis, and one with a foreign body in the lens. Posterior synechiæ are no contraindication for the use of the suction method for the extraction of the lens, and the rupture of the zonula Zinn did not cause loss of vitreous.

SCHOENBERG.

COLIN (50, **The simple extraction of cataract with suture of the corneal flap**) gives a detailed description of this method, as practised mainly by Kalt and Chevallereau on several hundred patients and discusses its ad- and disadvantages. The main advantages are: (1) Iridectomy is unnecessary; (2) the coaptation of the lips of the wound is better and more rapid than that obtainable by the classical method; (3) vitreous is never lost; (4) it is not necessary to operate on both eyes and the patient may be allowed to sit up very soon after the operation. The disadvantages are: (1) frequent occurrence of iris prolapse; (2) difficulty of technique. The method is not indicated in young patients with soft cataracts and is contraindicated in patients with unclean conjunctivæ.

SCHOENBERG.

PAINE (51, **Operation for the extraction of lenses fully dis-**

located into the vitreous) suggests the use of a strong light focused on the eyeball to illuminate the interior so that the lens may be seen and be more readily extracted by means of a hook. He relates five cases in which this method was successfully employed.

ALLING.

XV.—THE CHOROID.

52. OPIN. **Benignant tumor of the choroid.** *Annales d'oculistique*, cliv., 12.

53. VAN SCHEVENSTEEN. **A case of retinochoroiditis complicating spirochetosis ictero-hemorrhagica.** *Ibid.*, cliv., 12.

OPIN (52, **Benignant tumor of the choroid**) found in an eye enucleated for iridocyclitic glaucoma a tumor of the choroid which consisted of a proliferation of connective tissue and was diagnosed by pathologists as "œdematous fibroma," possibly myxoma. The tumor was the size of a large shot and was located midway between the ora serrata and the optic disk. The author found no case similar to the present one in literature.

SCHOENBERG.

VAN SCHEVENSTEEN'S (53, **Retinochoroiditis complicating spirochetosis ictero-hemorrhagica**) patient, a soldier (age not given), was recovering from an attack of spirochetosis icterohemorrhagica when he developed a patch of chorioretinitis in his left eye followed by a similar condition in his right eye a few weeks later. The urine became albuminous at the same time. It required two months for the vitreous opacities to disappear and the chorioretinal patches to begin to be absorbed. In three other cases of spirochetosis ictero-hemorrhagica observed by the author; no fundus changes were discernible and the vision was not affected.

SCHOENBERG.

XVI.—SYMPATHETIC OPHTHALMIA.

54. MORAX, V. **Sympathetic uveitis.** *Annales d'oculistique*, cliv., 7.

55. MORAX, V. **Clinical and statistical notes on sympathetic ophthalmia in the armies.** *Ibid.*, cliv., 12.

56. POULARD, A. **Sympathetic ophthalmia.** *Ibid.*, cliv., 12.

57. POULARD, A. **Abnormal sympathetic ophthalmia.** *Ibid.*, cliv., 12.

58. VAN SCHEVENSTEEN, JR. **Sympathetic ophthalmia.** *Ibid.*, cliv., 8.

Morax (54, **Sympathetic uveitis**) is convinced that sympathetic ophthalmia is due to an infective agent. He has made microscopic examinations of all the eyes enucleated by him and several others during the war and found changes absolutely characteristic in those affected by this disease. These changes consist of a diffuse or nodular lymphocytic infiltration of the choroid. The retina shows very mild lesions or none. The point of entrance of the infective agent is usually in the region of the posterior pole (usually introduced by a foreign body lodged in the choroid). Some rare cases are due to injuries of the iris and ciliary body. Schoenberg.

Morax (55, **Clinical and statistical notes on sympathetic ophthalmia in the armies**) has collected thirty-nine histories of all the cases of sympathetic ophthalmia which occurred during this war in the French army. Thirty-one were due to projectiles, four to accidents, three were post-operative, and one followed an ulcer of the cornea. Abscission of the prolapsed iris, covering of the wound with a conjunctival flap, amputation of the anterior portion of the globe, evisceration, and even enucleation do not always prevent the occurrence of sympathetic ophthalmia, even when done immediately after the injury has taken place. Since a period of at least fourteen days always passed between the injury and the appearance of the first symptoms of sympathetic ophthalmia, the very important conclusion is to be drawn that enucleation can prevent this complication only if performed within two weeks after the injury. Evisceration does not offer a safe preventive measure, since Dr. Kalt has seen a case of sympathetic ophthalmia following an evisceration performed four days after the injury. The period of incubation varied in the thirty-nine cases between fifteen days and two years. As to the clinical types observed there were thirty-one cases with the classical appearance of iridochoroiditis and eight which began as an optic neuritis and choroiditis. The outcome as to the vision was as follows: twelve ended in complete blindness; one remained with V. = $\frac{1}{10}$; one committed suicide; twenty had V. = $\frac{5}{10}$ to $\frac{10}{10}$ and five had V. = $\frac{3}{10} - \frac{4}{10}$.

Schoenberg.

Poulard (56, **Sympathetic ophthalmia**) says that preventive enucleations against sympathetic ophthalmia are a superfluous maiming since this disease's occurrence is of extreme rarity. In war injuries whenever enucleation is necessary, removal of the anterior portion of the eyeball answers the purpose and has the great advantage of furnishing a better support for an artificial eye.

SCHOENBERG.

POULARD (57, **Abnormal sympathetic ophthalmia**) reports the history of the single case of sympathetic ophthalmia he has seen in this war. The unusual feature about this case is that the sympathetic ophthalmia developed in the left eye four months after the enucleation of the right eye, injured five weeks previously.

SCHOENBERG.

VAN SCHEVENSTEEN (58, **Sympathetic ophthalmia**) publishes the history and pathological examination of the first case of sympathetic ophthalmia developed from a war injury in France. The clinical evolution was characteristic and the microscopic changes consisted of a lymphocytic infiltration, diffuse in some parts, nodular in others, found only in the uvea. The retina remained intact. He believes that the statistics of sympathetic ophthalmia in this war cannot be written for many years, since many an injured eye may give rise to this complication in some future time.

SCHOENBERG.

XVII.—GLAUCOMA AND INTRAOCULAR TENSION.

59. GIFFORD, HAROLD. **Glaucoma from the absorption of senile cataract.** *American Journal of Ophthalmology*, February, 1918.

60. MAGITOT, A. **The physiological intraocular pressure.** *Annales d'oculistique*, cliv., 5, 6, 7.

61. PARENTAU. **The homeopathic treatment of glaucoma.** *La clinique ophtalmologique*, viii., 8.

62. PARKER, W. R. **The management of cases of non-inflammatory glaucoma classified as simple anterior and simple posterior glaucoma.** *American Journal of Ophthalmology*, September, 1918.

GIFFORD (59, **Glaucoma from the absorption of senile cataract**) has seen ten cases of spontaneous absorption of cataract. In three useful vision resulted and he thinks that the others would have terminated satisfactorily except for the intercurrence of glaucoma. It has been supposed by former observers that the glaucoma or some inflammatory complication was the cause of the cataract absorption, but he is of the opinion that glaucoma is the result. His theory is that toxic products incidental to degeneration of the cortex produce the glaucoma or that possibly it may result from the escape of cortical matter into the anterior chamber. He does not see how a freely movable nucleus in the liquid cortex can produce irritation.

ALLING.

PARENTAU (61, **The homeopathic treatment of glaucoma**) says that the medical means of treating chronic glaucoma by allopaths are very limited in number and that the homeopaths have a great variety of drugs which give better results. He recommends the use of very weak (homeopathic) dilutions of eserin and pilocarpin for local applications and atropin, cocain, caustic potash, and phosphor in homeopathic doses taken internally. Four histories of cases with glaucoma are given to illustrate his contentions.

SCHOENBERG.

If the posterior lymph spaces of the eye are blocked the lens and iris will be pushed forward, whereas with interference with the anterior drainage they will remain in the normal position. Classifying the cases on this basis PARKER (62, **Management of cases of non-inflammatory glaucoma classified as simple anterior and simple posterior glaucoma**) thinks that an iridectomy will relieve the circulation in the anterior variety but that in the posterior it is of no avail. The trephine operation looks toward establishing a filtration cicatrix which permits the fluids of the eye to pass and would be indicated if the posterior channels were involved. All cases of simple glaucoma which can be classified as anterior, with the exception of those with narrow fields, should be treated with iridectomy, while all cases of posterior glaucoma as well as those with contracted fields should be trephined. These suggestions are based upon clinical observations and verified by examinations of pathological specimens.

ALLING.

From a critical study of the literature MAGITOT (60, **The physiological intraocular pressure**) draws conclusions, some of which are entirely at variance with the current ideas on this subject. The ocular tension depends to some degree upon the general blood pressure, but the eyes possess an auto-regulatory apparatus which counteracts the effect of high blood pressure. The factors determining the ocular tension are: (*a*) The general circulation; (*b*) the local circulation (in the eye); (*c*) the walls of the eyeball. The uvea plays the most important rôle in determining the ocular tension. This is an erectile tissue composed almost exclusively of blood-vessels and on its more or less active state of engorgement depends the ocular tension. The uvea contains nerve-fibers and cells of sympathetic origin with a vasomotor function. The variations of blood pressure produce certain changes in the ocular tension. The decrease of blood pressure is followed by a proportionate lowering of the ocular tension, but the high blood pressure does not produce a marked increase of tension in the eyeball. On the other hand the ocular tension is very intimately related with and depends upon the local, uveal circulation. Artificially induced hyperæmia of the uvea is followed by an increase of tension. The cervical sympathetic has a regulatory influence upon the uveal circulation and thereby upon the ocular tension, but far greater is the influence of the peripheric sympathetic, consisting of nerve-fibers and cells situated in the uvea, upon the ocular tension. This ocular sympathetic center is mainly responsible for all the physiological as well as pathological variations of the ocular tension.

The aqueous humor has nothing to do with the ocular tension. It is not—as almost everybody believes—continually secreted and excreted. Its function is mechanical, and provides a water cushion to the tissues surrounding it.

The ocular tension depends only upon the state of engorgement of the uveal blood-vessels and this is regulated by the vasomotor innervation supplied by the uveal sympathetic.

SCHOENBERG.

XVIII.—THE RETINA AND VITREOUS.

63. APPLEMAN, L. F. **Massive spontaneous hemorrhages into the vitreous.** *American Journal of Ophthalmology*, January, 1918.

64. BURKHOLDER, C. A. **Hole in the macula.** *Ibid.*, February, 1918.

65. JENNINGS, J. E. **Aneurysms of the retinal arteries.** *Ibid.*, January, 1918.

66. LLOYD, R. I. **Blocking of macular arterioles as a cause of central and paracentral scotoma of the macular bundle.** *Ibid.*, June, 1918.

67. ROCHON-DUVIGNEAUD, A. **The functions of the rods and cones as indicated by comparative physiology.** *Annales d'oculistique*, cliv., 11.

APPLEMAN (63, **Massive spontaneous hemorrhages into the vitreous**) reports three cases of extensive hemorrhages into the vitreous. One he thinks was due to septic absorption from a pyorrhea. The other patients were syphilitic. Causes which have been assigned to this type are alteration in the blood circulation, change about puberty, and local vascular disease due to various systemic diseases among which are syphilis and tuberculosis.

ALLING.

BURKHOLDER (64, **Hole in the macula**) found a circular excavation in the macular region slightly larger than the disk. It was about 1 *mm* deep and had a sharply marked pigmented border. The floor was a mottled deep red color and there were a few cholesterin crystals in the base and surrounding retina. When a boy, the patient had received a severe blow on the eye and was totally blind for a few days.

ALLING.

JENNINGS (65, **Aneurysms of the retinal arteries**) found in the left eye of his patient, a young man of 21, a normal optic nerve but in the macular region a large collection of white dots. The retinal veins in some places were twice their normal size and in others reduced to threads. At different places in the arteries were eighteen aneurysms, the larger ones having a bright central reflex. There were also numerous hemorrhages. The other eye was normal.

ALLING.

LLOYD'S (66, **Blocking of macular arterioles as a cause of central and paracentral scotoma of the macular bundle**) case complained of sudden dimness of vision, and he found œdema of the retina extending in a curve from the disk to the macula. A permanent scotoma corresponding to this area remained, and he thinks the condition one of block of the inferior macular artery. The defect is best shown with a chart from the stereoscopic campimeter.

ALLING.

ROCHON-DUVIGNEAUD (67, **The functions of rods and cones as indicated by comparative physiology**) has studied microscopic sections of retinæ of reptiles and confirms the findings of

Max Schultze who, as far back as 1866, found that the retina of diurnal animals contains more cones and that of nocturnal ones mostly rods. Rochon-Duvigneaud has found that the chameleon has a retina containing exclusively cones and that the nocturnal lizard has the retina provided only with rods. Not only the structure of the retina, but also the entire conformation of the eye gives a clue as to the diurnal or nocturnal character of the animal. For instance the eye of the chameleon has an extremely small cornea, the pupil is very small, round, and is immobile to light mydriatics and myotics. Death or experimental destruction of the brain does not change the size of its pupils. These eyes represent the extreme type of visual organs adapted for daylight only. The structural composition of the retina, in the region of the fovea centralis, with its extraordinary abundance in very small cones, must give an almost microscopic visual acuity to this animal. The eye of a nocturnal lizard, on the other hand, presents a number of characteristics peculiar to nocturnal vision; a large cornea, an oval, large pupil, reacting very promptly to the slightest variations of intensity of light, an absence of fovea centralis, consequently no central vision. SCHOENBERG.

XIX.—THE OPTIC NERVE.

68. BANE, W. C. **Cyst of the dural sheath of the optic nerve.** *American Journal of Ophthalmology*, January, 1918.

69. LENOIR, M. **Acute, infectious retrobulbar neuritis.** *Annales d'oculistique*, cliv., 7.

BANE'S (68, **Cyst of the dural sheath of the optic nerve**) patient was a boy of six years who was blind in the left eye with the nerve atrophic. There was also a marked exophthalmos and limitation of motion. An X-ray showed no sinus involvement or tumor. The operation was performed by severing the external rectus and securing it with a suture, then dissecting backward close to the eyeball. A smooth round mass was disclosed firmly attached to the sclera about the nerve entrance and enveloping the nerve itself. The cyst was ruptured and a clear fluid escaped. About 11*mm* of the nerve with the cyst wall was removed from its attachment to the globe. The cyst was probably derived from the pial and arachnoidal sheaths of the optic nerve. ALLING.

Lenoir (69, **Acute, infectious retrobulbar neuritis**) reviews the well-known symptoms and pathogeny of the acute retrobulbar neuritis and expresses his belief that syphilis, rheumatism, and multiple sclerosis have nothing to do with this condition. He doubts even whether posterior ethmoiditis and sphenoiditis play an important and frequent rôle in its causation. As the most probable cause of retrobulbar neuritis he accepts the old idea of Parinaud, namely that it is due to an extension of a meningitis to the macular bundle of the optic nerve. SCHOENBERG.

XX.—ACCIDENTS, INJURIES, AND PARASITES.

70. Friedenwald, N. **Luxation and evulsion of eyeball during birth.** *American Journal of Ophthalmology*, January, 1918.

71. Heckel, E. B. **Whip-cracker injury of the eye.** *American Journal of Ophthalmology*, July, 1918.

72. Luna, P. **Disturbances of vision in patients harboring certain filarial tumors.** *Ibid.*, February, 1918.

73. Posey, W. C. **Injury to the eyes from lightning stroke.** *Ibid.*, February, 1918.

Friedenwald (70, **Luxation and evulsion of eyeball during birth**) has collected twenty-nine cases of this sort from literature. He was called to see a child one and a half hours after birth and found the left eye completely luxated through the lids. It was necessary to enlarge the palpebral fissure before the eye could be returned. When seen two years later the eye was to all appearances normal.

ALLING.

Heckel (71, **Whip-cracker injury of the eye**) reports three cases in which a small piece of fine brass wire entered the eye from the cracker of a whip. In one the foreign body was in the cornea and anterior chamber. In another the X-ray showed it to be in the posterior vitreous, while the third was imbedded in the posterior sclera. The first was removed, the second left in situ as enucleation was refused, and the third was found in the enucleated eye. In snapping a whip the lash must attain a very high velocity for the bit of wire to strike the eye with sufficient force to penetrate the sclera.

ALLING.

Luna (72, **Disturbances of vision in patients harboring certain filarial tumors**) has observed eye lesions in patients suffering from a disease known in Central America as Coast Erysipelas and caused by a parasite not exactly identified. He found superficial punctate keratitis complicated by a plastic iritis. The disease usually results in blindness. Another manifestation is amblyopsis without discoverable lesion which he thinks is due to toxins produced by the parasite.

ALLING.

POSEY (73, **Injury to the eyes from lightning stroke**) has seen two cases of this sort. The first was a boy who was rendered unconscious by a stroke of lightning and whose face and hair were burned. The upper lid of one eye was reported to have been œdematous, the pupil small, and he suffered from photophobia. The fundus showed retinal œdema but no detachment or hemorrhages. The vision was not recorded. When seen by Posey the eye was quiet and projection good. He did a cautious needling; there was a cataract but results not recorded. The second case was blinded in a similar way and when seen a month later could only count fingers. There was œdema of both retinæ and the nerves were hyperæmic and blurred. After another month the eyes returned to normal.

ALLING.

BOOK REVIEWS.

I.—**Glaucoma.** A textbook for the student of Ophthalmology. By Col. ROBERT HENRY ELLIOT. 158 illustrations, pp. 546. H. K. Lewis & Co., London. P. B. Hoeber, 67 East 59th Street, New York, 1918. Price $7.50.

A comprehensive work on the present state of our knowledge of glaucoma is surely timely, and no one is better fitted to give an authoritative critique of the voluminous literature on this subject than Colonel Elliot. Very wisely the ground is first cleared by an exact definition of the terms which are so often vaguely used in discussing the problems connected with glaucoma. After a brief description of the anatomy of the structures of the eyeball affected in glaucoma, the various factors are reviewed whose function is to regulate intraocular pressure. It is shown that the contents of the eye are not fixed and alterations in pressure are compensated for by definite methods, and that the tunics of the eye are not rigid. There is a difference, though slight, between the two divisions of the aqueous chamber and the pressure in the vitreous must be necessarily still higher, otherwise no flow could take place. The eyeball is not a closed chamber but one through which fluid is constantly passing, making the problem one of hydrodynamics and not one of hydrostatics. The production of intraocular fluid is both a pressure filtration and a secretion. Rise of general blood-pressure does not generally affect intraocular pressure. Fluid leaves the eye from the anterior chamber by osmotic action in which Thomson's pump action (*The Ophthalmoscope*, vol. ix., 1911, p. 470) is an important factor.

In the chapter on Etiology, the pathological anatomy is first described. Schnabel's theory of cavernous atrophy of the optic nerve is regarded as fantastic, though it served to draw attention to the cases of continuance of optic atrophy after the primary cause of that atrophy is removed. The writer believes that the continuation of the optic atrophy in cases where trephining was apparently successful, is due to an associated autogenetic autointoxication; the optic nerve is primarily damaged by glaucoma and cannot resist the attacks of autogenetic poison. It has occurred to the reviewer that some toxic process of this kind must be assumed in the cases of glaucoma with central scotoma which are not infrequent; at the same time the search for this factor has not been successful. The hydrophyllic theory (Fischer's œdema from acidosis) is dismissed because of weakness of evidence. According to the author, the evidence in favor of the closure of the iris angle being causative of the rise in intraocular pressure is overwhelming. The decisive factor in determining the onset of glaucoma is the size of the eye relative to that of the lens it contains, and in the chronic cases changes in the size and position of the lens are the most important ones. In the causation of glaucoma the writer (p. 99) lays stress upon the fact that it may be due to (1) an interference with the balance normally held between secretion and excretion in the eye, or (2) an obstruction to the escape of blood from the eye, or (3) a combination of these influences.

The chapter on Diagnosis of glaucoma begins with the clinical manifestations of the various forms and a description of the signs and symptoms from an anatomical standpoint. In discussing (p. 175) the ophthalmoscopic changes the writer says that the usual cup may be absent and the cupped part be limited to the center,—in other words, incomplete; this later goes on to a complete cup and in the preglaucomatous stage a central circular physiological cup would be present. Cupping may exceptionally imitate a physiological excavation and confusion may arise when a nerve-head with a deep physiological cup undergoes simple atrophy. The field examination is carefully gone into (small and large object perimetry) with due attention to recent important investigations, such as Bjerrum's screen, Roenne's nasal step, Bjerrum's sign, and Seidel's sign (paracentral scotoma). The value of the Schiotz tonometer is fully granted, though the writer thinks its most important rôle is rather as a means to watch the progress of a case and to control our success in combating the rise of intraocular tension. A diminution in the differential light sense is an early symptom and should receive further investigation.

The various forms of secondary glaucoma are then taken up. Intumescent cataract as a cause was frequent in the author's Madras experience. Treatment consists in preliminary iridectomy followed by extraction as soon as the eye has quieted down. A posterior sclerotomy may be necessary before the iridectomy. Glaucoma following the needling of an after cataract was a condition especially studied by Herman Knapp, who found that it was always relieved by an iridectomy. In the reviewer's opinion, the condition results from a sudden mixture of vitreous and aqueous interfering with the normal outflow from the eye and a simple paracentesis is sufficient to relieve the condition. In iridocyclitis with increased tension, if antiphlogistic measures do not avail, Elliot advises the use of atropin boldly with preparation to proceed surgically if the tension be increased.

Buphthalmos, the congenital variety of glaucoma, is fully described; the outcome in spontaneous detachment of the retina and subsequent phthisis is not mentioned, though this possibility must be kept in mind before operating. Trephining offers the best chance from an operative standpoint, which is practically the only one. In its performance it is not necessary to split the cornea, as the conjunctiva strips back off the cornea to an unusual distance. The writer says the possibility of congenital syphilis must never be forgotten in these cases.

Unfortunately, no adequate description is given of "glaucoma simplex," that well-defined form of glaucoma which occurs in older patients and is characterized by optic atrophy out of proportion to the shallow cupping, by a very much contracted field, and by tonometric readings generally within the upper limit. This is the variety of glaucoma, if it be glaucoma, upon which a fistulizing operation exerts no favorable influence.

As for treatment, the author recognizes the importance of general treatment and massage of the eye, but does not take a particularly favorable view of the results to be obtained from miotic treatment. The danger of a rise in tension occurs during sleep (p. 367), and the writer therefore suggests the instillation of a drop the last thing at night. This is not in accord with the experience of some oculists as it is a common experience for sleep to control a glaucomatous attack.

The question of operation, and when to operate, is then taken up. The author believes that in this his belief must be shared by all, that the earlier the operation the better the result, and that iridectomy can only be effective in early cases where the angle of the anterior chamber is not blocked; after this stage an operation for the formation of a filtering scar must be done. It is in connection with the last group that the author describes the newer operations for glaucoma. This important part of the book deals with the history of these operations, with preparations for operation, and a description among other operations of Lagrange's operation and particularly of the author's operation (sclerocorneal trephining).

The technique for trephining is most exhaustively entered into; each step is carefully analyzed and the reasons for its performance given. A *2mm* instrument is preferred, principally to give room enough to deal satisfactorily with impaction of the iris; the size of the opening can be reduced by cutting off any desired portion of the disk. If the iris does not present, the writer believes it to be better to leave it alone. After the iridectomy, the iris is replaced best with an irrigator. The complications or accidents occurring during the performance of the operation, the after-treatment, and the late complications are fully described. Late infections can be practically avoided, in the writer's opinion, by the use of "thick flaps."

In an appendix the author's scotometer is described, a device combining the advantages of Priestley Smith's revolving scotometer with those of the Bjerrum screen.

This book is a mine of information even to the experienced oculist, besides being a scientific and practical exposition of glaucoma in all its phases. It should serve to remedy the many errors which occur so frequently in the management of these desperate cases. Operations which successfully cause a fistulization are an enormous step in advance in the treatment of glaucoma, and in this progress Colonel Elliot's name will always be preëminent.

A. K.

II.—**Hygiene of the Eye.** By Dr. W. CAMPBELL POSEY, Philadelphia. 344 pages. 120 illustrations. Publishers, J. B. Lippincott Co., Philadelphia, 1918.

It is quite in line with the attention that is now being given to preventive medicine that there should be a book on Hygiene of the Eye. The author, Dr. Posey, has wisely selected experts to write on the physical problems which constitute so important a part of the subject; Artificial Lighting is treated by Herbert E. Ives, and Daylight Illumination of rooms and buildings from an architectural standpoint is by W. C. Farber. These chapters contain valuable information on subjects which are attracting more and more attention, and whose importance is gradually being realized. After a simple description of the anatomy and physiology of the eye and of the ophthalmoscope, the refractive errors and strabismus are treated in an elementary, though perfectly comprehensive, way. The various systemic disturbances which accompany these conditions are described and much sound advice is found in the chapter on School Life and Care of Eyes. In the clinical part, the Diseases of the Conjunctiva, Eyelids, Choroid, Retina, Optic Nerve and the subjects of Cataract and Glaucoma are briefly discussed. The important relation of the Eye to General Disease is the subject of the next chapter. Under Wounds and Injuries the author gives an excellent account of the Industrial Injuries of the Eyes. Finally a chapter on the Blind, their education and employment, by O. H. Burritt, and one on Conservation of Vision by E. M. Van Cleve, conclude the volume.

The information which Dr. Posey has collected must appeal to a wide circle of readers. The subject matter is presented in an unusually clear and readable manner. Some of the individual topics are essential to the general practitioner, teacher, social worker, and to the laity in general. The subjects of lighting, industrial injuries, the blind, and the conservation of vision should be of particular interest to the oculist, as they are the work of specialists and represent expert opinion on subjects of great importance to the community, and about which the desired information is not always easy to find. The book is excellently printed on dull paper and the illustrations in black and white are well chosen. A. K.

III.—**Concerning Some Headaches and Eye Disorders of Nasal Origin.** By Dr. GREENFIELD SLUDER. St. Louis. Pp. 270. C. V. Mosby & Co., 1918.

Following Dr. A. E. Ewing's suggestion that certain asthenopias are due to nose conditions not yet fully understood, the author was led to study the nasal factor in headaches and in eye lesions. The proper interpretation of the underlying pathological features belongs to Dr. Jonathan Wright. These consist in chronic inflammatory changes which begin in the soft parts and then cause bone changes either as bone absorption or as bone forming. Grave symptoms result when sensitive nerves or nerves of special sense are affected. Avoiding the self-evident paranasal sinus suppuration, the author describes three varieties of nasal disease or of clinical pictures which have as symptoms, headache and some eye disorder: (1) closure of the frontal sinus without suppuration; (2) the syndrome of nasal ganglion neurosis; (3) the picture of hyperplastic sphenoiditis.

1. In the first group, closure of frontal sinus without suppuration, the patients only have eye symptoms. The air in the sinus is absorbed, negative pressure makes the walls sensitive. The eye symptoms are those of asthenopia. This subject was presented by Ewing and Sluder before the American Ophthalmological Society in 1900. There is a tender point in the upper inner angle of the orbit, at the pulley and interior and just posterior to it (Ewing's sign). The rhinologist's findings are usually negative. The tugging of the superior oblique on this wall causes the pain. Sluder has seen 580 cases. Treatment consists in the application of astringents or the removal of the middle turbinal.

2. Nasal ganglion neurosis: The spheno-palatine ganglion is located in the spheno-maxillary fossa which is in intimate relation to the nose and paranasal cells. The spheno-palatine foramen lies just posterior to the tip of the middle turbinal. The ganglion is 1 or 2 to 9*mm* from the nose. The ganglion can be involved in posterior ethmoidal and sphenoidal suppuration or directly from the nose. The symptoms are those of a coryza followed by pain of a neuralgic type at the root of the nose, about the eye, upper jaw, and teeth, extending back to a point 5*cm* back of the mastoid and down to the arm

and shoulder, or the symptoms are those of the sympathetic type with vasomotor and secretory phenomena, severe sneezing, nasal congestion and thin discharge, congestion of the conjunctiva, lacrymation, dilatation of pupil, "stary look," photophobia, etc. These symptoms are relieved after cocainizing the ganglion. Injections of this ganglion have cured blepharospasm, corneal ulcer, relieved the severe pain of uveitis, glaucoma, interstitial keratitis, etc. Ewing found that the pain of glaucoma could be stopped in this way, and Miller and Luedde observed transitory lowering of tension in glaucoma.

3. Hyperplastic sphenoiditis: In the anatomical introduction the author shows that the 2d and 3d divisions of the V. nerve and the Vidian nerve are usually well removed from the sphenoid sinus, in fact the VI. nerve and the 3d branch of the V. nerve are the only ones not at times in close relation with this cell, unless it is prolonged into the greater wings or backward. The sphenoid sinus may even come in close relation to the semilunar ganglion. In the sphenoidal fissure the II.,VI., and ophthalmic nerves are separated from the sphenoidal cavity by thin bone. The author believes that a large number of the frequently recurring headaches usually called migraine are of sphenoidal origin. The eye changes are retrobulbar neuritis, transitory amblyopia, choroiditis, ocular palsies (III., IV., and VI. nerves) which are of the type of ophthalmoplegic migraine, cyclitis, and ophthalmic migraine. After removal of the anterior wall Holmes's naso-pharyngoscope shows thickening of membrane, localized inflammation, polypi, etc. Optic nerve disorders are frequently caused by hyperplastic bone changes in the sphenopostethmoidal region, preceded in a large percentage by headache. This bone process, a periostitis, narrows the bone canals through which the respective nerves pass. Sphenoidal lesions affect the oculomotor and abducent nerves more frequently than any of the other nerves in the sphenoidal fissure, though even these are infrequent.

The diagnosis of hyperplastic sphenoiditis and the author's operation for the "upper cells" are carefully considered.

A number of case histories conclude the book and illustrate, among others, the following eye conditions of interest to the oculist, which were observed in connection with nasal lesions: Vacuum frontal headache, blindness from sphenoiditis, blepharospasm and lacrymation, dilated pupil, paralysis of accommodation, ophthalmoplegic migraine, III. and VI. nerve paralyses, migraine, optic neuritis, tic, iritis, photophobia, transitory amblyopia, choroiditis, glaucoma.

The direct relation of the eye condition to the sinus disease in these cases is not always definite, principally because the description of the eye changes is not complete. This does not lessen the gratitude which oculists owe to Dr. Sluder for again drawing attention to the important interrelation of the eye and nose, and for his noteworthy contributions on this subject. Of particular interest are Dr. Sluder's original investigations on the nasal ganglion, especially its influence on the eye, such as the relief of pain in uveitis and in glaucoma after cocainizing this ganglion. A. K.

IV.—**Fractures of the Orbit and Injuries to the Eye in War.** By Felix Lagrange, Bordeaux. Translated by Herbert Child. Edited by J. Herbert Parsons. Pp. 248. 77 illustrations and 6 plates. Univ. of London Press, Ltd., London. Masson & Cie., Paris, 1918.

This is a translation of one of the volumes in the "Horizon" collection, the French series of war manuals.

After an historical introduction on fractures of the orbit by war projectiles, the orbital cavity is considered with reference to conformation, resistance to injury, and vulnerability. Fractures of the orbit occurred in 609 cases out of 2554 wounds inflicted in war which were observed in the author's service. Of these 609 the eyeball was destroyed in 212; the eyeball was preserved in 397, without any ocular lesion in 105 and with ocular lesions in 292. These lesions were chorioretinitis, atrophic and pigmented, 94, chorioretinitis proliferans 45, detachment of retina 40, vitreous hemorrhage 31, optic atrophy 29, optic neuritis 22, section of optic nerve 12, cataract 7, corneal lesions alone 6, laceration of optic nerve 4, subluxation of lens 2.

In addition, the adjoining nasal sinuses and the brain were involved in 154, the sensory nerve in 43, muscles 27, lacrymal passages 25, cellulitis of orbit 2.

The fractures of the orbit were practically always direct and the eyeball, though preserved in about ⅔ of the cases, was usually affected in one of the following ways: (*a*) The eyeball itself is not involved but its nerves and vessels are injured; (*b*) concussion injury of the eye; (*c*) a projectile grazing the eyeball without rupturing it or forcing the eye against the bony wall of the orbit, causes damage at the bruised point, ruptures of the choroid and retina, with detachment of the retina, often accompanied by macular changes. Actual cases are reported with an anatomical sketch of the projectile's path. The condition differs according to the retention or absence of foreign body. The concussion injuries are usually macular lesions without any other apparent injury to the eyeball. According to the author, the eye is shaken like a submerged boat when struck by a deep wave and the macular region is affected because it is the most fragile and because traction is localized to the posterior pole held back firmly by the optic nerve. The author even speaks of a clinical law: concussion of the eye without direct shock = macular and perimacular lesion. Larger choroidal lesions are ruptures caused by greater violence, and are always situated on the side of the orbital fracture. A remarkable injury is the tearing out of the papilla by sudden stretching of the optic nerve. After the blood has absorbed, the fundus picture shows torn vessels and a deep excavation due to rupture of the sclerotic. Hematoma of the nerve sheath has been observed in a number of cases with great probability though no histological examinations were available. Ophthalmoscopic signs of ischæmia or peripapillary hemorrhage were never observed, though after some time a brownish pigmented ring appeared around the disk.

Under cataract, two cases of lens opacity are reported which resulted from the shock of aerial waves on the eyeball from proximity to the explosion of a shell. The opacities were star-shaped, posterior, polar, and later became complete. Proliferating retinitis is always the result of hemorrhage. Rupture of the choroid and retina are followed, if small, by atrophic and pigmented chorioretinitis; if accompanied by considerable hemorrhage, by proliferation. Traumatic enophthalmos is described together with the observation of three new cases without adding anything to the knowledge of this curious affection.

Twenty-four ophthalmoscopic drawings in black and white illustrate the various forms of fundus changes observed in these fractures, showing hemorrhages, chorioretinal changes, ruptures, and proliferations.

Under treatment of ocular complications, sympathetic ophthalmia is first discussed. This occurred in 5 of 2554 injuries to the eyeball. Lagrange states that photophobia, lacrymation, fatigue in reading, and diminution of sight are the first degree of this affection, of which serous iritis is the second degree and iridocyclitis is the third. If an eye contains a foreign body and still has useful sight, it should be left alone. If it no longer has vision and if the foreign body is in the ciliary region, the eye should be enucleated even if there is no pain or irritation. If the foreign body is elsewhere and the eye is quiet, it can be left; if it is reduced in tension, slightly tender, and its nutrition is visibly suffering, the eye should be removed. The author recommends the following procedure for treating detachment of the retina. It consists in creating in the region of the canal of Schlemm beneath the conjunctiva cicatricial tissue obliterating the filtration spaces. This is alone indicated in hypotonic, relaxed eyes, otherwise treatment consists in subconjunctival salt injections, atropin, bandage, and prolonged rest in bed. Of 135 cases, complete recovery was observed in three, improvement in eight. A chapter on reparative surgery of the orbit by means of adipose and cartilaginous grafts concludes the book. A. K.

V.—**Atlas d'Ophtalmoscopie de Guerre.** By Professor FELIX LAGRANGE, Bordeaux. Text in French and English. 100 plates of which 20 are in colors. Masson et Cie., Paris, 1918.

Ophthalmoscopic changes occur in war with much greater frequency than one would at first expect, as, in addition to the more usual injuries, commotion of the air and contusions of the bones of the face surrounding the orbit are often followed by changes in the eye grounds. These changes were so frequent that the author was led to collect his observations in an atlas. The drawings were made by an artist, Camille de Buzon, with the aid of the Thorner and the Gullstrand ophthalmoscopes.

The cases studied are arranged in the following six groups: I. Lesion of the inner membranes by concussion at a distance; II. Lesions of the optic canal; III. Macular and paramacular lesions by concussion of the facial bony structures, not directly involving the orbit; IV. Concussion changes at posterior pole, peripheric lesion by contact from a missile passing through orbit; V. Lesions of inner membranes by a missile injuring them behind the eyeball; VI. Lesions of the inner membranes in contusion of the eyeball. Of particular interest are the intraocular changes following a concussion of the neighborhood, an original observation of Lagrange which was first published on May 15, 1915. The lesions are choroidal, subretinal ruptures, hemorrhages followed by complete reabsorption or by the formation of more or less bulky pigmentary deposits. These changes always occur at the posterior pole as has been explained in "Fractures of the Orbit" (see preceding review). Similar changes at the macula are observed after direct injury to the eyeball.

Each plate is accompanied with a brief history of the case it illustrates, a diagram of the course of the projectile, and a report of the fundus condition, thus furnishing a complete clinical picture. The drawings in black and white convey an adequate impression of the fundus changes while the ones in color are excellent. This collection of war pictures is a most valuable contribution to clinical ophthalmoscopy, and throws a new light upon many fundus changes which are occasionally seen in ordinary hospital work.

A. K.

VI.—**Les Borgnes de la Guerre** (The One-eyed in War). By Dr. G. Valois of Paris. Pages 236, many illustrations. Publishers, Masson et Cie., Paris, 1918.

In the introduction it is stated that the frequency of ocular injuries is much greater than in any previous war, though sympathetic ophthalmia has been rare. Enucleations were frequent; one surgeon estimated this operation to be 60% of those performed on the eye.

The difficulty of inserting the artificial eye depends upon abnormality or irregularity of the cavity. In peace times it is simple enough to form more or less identical orbital cavities after enucleation,—in other words, the preparation for the artificial eye is comparatively simple and often consists in a partial operation, such as exenteration or amputation of the anterior segment. In the war wounds conditions, however, were entirely different.

The desire for motility, appearance, and prominence of the artificial eye has led to complete enucleations with grafts of living substance and with muscular reinsertion. To obtain a good cosmetic result a cavity has to be prepared to hold the artificial eye in a good position. There must be a surface or a stump sufficient to support the artificial eye, and, second, the artificial eye must fit well.

The development of a proper cavity is aided by the insertion of a provisional body which consists of polished ebony of the form of a half olive, and is slightly curved. A cross on the anterior surface indicates the proper axis. This splint should be applied directly after the operation; it will then show the condition of the eyelids, the form of the cavity, and the dimensions of the cul-de-sac. It makes the suture of the eyelids whenever necessary very much more easy, giving them the form which is desired. It also prevents deformities and postoperative adhesions. Whenever enucleation is done in cases where there is a discharging fistula from the depth, it is of advantage to have a fenestrated olive which will permit drainage.

The orbital cavity presents the following lesions: cicatricial bands, cicatricial contractions, partial or complete symblepharon. The bands usually start from the surface wound, usually of the eyelids. A fibrous tract unites the two opposing walls and the mucous membrane projects. The new-formed scar is dense, all elasticity of the region is lost and no movement is permitted. Sometimes it is connected with an opening in the deeper parts of the orbit. In other cases a band will form a bridge crossing the cul-de-sac placed between the length of the eyelid and of the orbit. In order to relieve any of these cicatricial bands, there is only one operation which is of value, and that consists in making a large incision along the outer orbital margin about 3 or 4*cm* long, detaching the one eyelid from the other. A suture is passed through each eyelid, and using them as retractors, the lids are separated. Then with the scissors, the conjunctiva can be dissected free from the underlying cicatricial tissue, and the various cicatricial bands can be thoroughly excised. The margins of the lids are freshened and sutured after the olivary piece has been inserted. It is best to leave the orbit in this condition for about three months before separating the two eyelids.

If the cavity is too small, Coulomb has obtained good results by gradual dilatation with the use of olive-shaped splints of increasing size. In fact the wearing of one of these splints exerts a good action upon the shape of the cavity.

The cavity may be contracted by scars of the conjunctiva following injuries to the orbit. The restoration of these cavities by surgical means is often deceiving as the procedure is a difficult one and the results are inconstant. In general, there is one principle and that is that the only means of enlarging the cavity is by the addition of new tissue. This is obtained either by the use of cutaneous flaps taken from a distance or by pedunculated flaps from the adjoining region by twisting its peduncle or crossing the outer canthus. In general the cutaneous graft is used. This varies in thickness from the entire thickness of the skin to only a superficial part.

As to the support of the artificial eye, the atrophic eyeball can only serve if there is not the slightest suspicion of a possible sympathetic irritation, though these are the eyes which give the best support to the artificial eye. In general, particularly after war injuries, it is necessary to enucleate. As far as possible, it is well to preserve the integrity of the conjunctival sac and not to disturb the insertion of the motor apparatus, so that its function will be restored. Unfortunately, simple enucleation is the least advantageous for a prothesis which has but little motility and exhibits an unsightly depression over the upper lid, as the muscles are irregularly united in a central scar and the contraction of one muscle causes a deformation rather than a movement. Hence we endeavor to keep open Tenon's capsule by the insertion of costal cartilage, by a round piece of skin, decalcified bone, or a piece of sclera. The selected graft then serves for a point upon which the tendons will act. To prevent the tendons from becoming united several authors have sutured each muscle to the overlying conjunctiva to conserve the anatomic relationship.

Ocular stumps are obtained without enucleation by amputation of the anterior segment, optico-ciliary neurectomy, and exenteration of the eyeball. The first gives excellent cosmetic results, though it can only be applied in a limited series of cases. Optico-ciliary neurectomy has been abandoned. Exenteration gives a very simple method of treating wounds of the eye. Its safety from sympathy depends upon the complete removal of choroidal tissue. This is sometimes done more easily than in others, at the same time it does not give an absolute safeguard against sympathy. The resulting cosmetic results, comparing enucleation and exenteration, are distinctly in favor of exenteration. Mules recommended the insertion of a glass ball. This has been generally abandoned on account of the many failures and the more or less great reaction which has followed this procedure. An important point has been brought up by Dor, who found that in the later results the eyes which have been subjected to enucleation give very much less trouble than those in which a substitute operation has been done.

The rigid surface is supplied by a scleral graft, according to a special method of Valois, which is as follows: The four tendons of the recti muscles are first isolated and sutured to the overlying conjunctiva before a tenotomy is performed. The enucleation then follows as usual. A scleral flap is then taken from the posterior surface of the enucleated eyeball. This has the shape of a lozenge 2½ by ½*cm*. At each extremity of this graft four doubly armed sutures are inserted. The graft is then placed in Tenon's space with its convexity forward. It is fixed by passing the sutures through the overlying conjunctiva and then united. It is well to insert the sutures as far away from the conjunctival margin as possible. This increases the extent of the movements of the artificial eye; finally, the conjunctiva is carefully sutured.

The rest of the book deals with the preparation of the artificial eye and with the "prothèse postiche orbito-palpébrale."

A. K.

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ARCHIVES OF OPHTHALMOLOGY.

OBSERVATIONS ON EYE WORK WITH THE BRITISH EXPEDITIONARY FORCES IN FRANCE.[1]

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THE present observations are concerned chiefly with the Eye Service of the B. E. F., which the writer had an opportunity to observe during the period of thirteen months—May, 1917, to June, 1918,—when he was attached to U. S. Base Hospital No. 5, which was stationed first at Camiers and then at Boulogne. During the very early months of the war there were a few regular R. A. M. C. officers doing eye work in France. In November, 1914, Col. W. T. Lister was appointed Ophthalmic Consultant to the B. E. F. He took up his station in Boulogne at the end of November, 1914, and began the organization of his Service there. In a general way, the British hospitals may be divided into three lines: First, the front line hospitals (the casualty clearing stations); secondly, the line of more permanent hospitals which stretches itself along the coast of France in the north; and thirdly, the hospitals in England—these latter I do not propose to touch on. The British had an eye center for each of their five armies, and in the case of one army there were two eye centers. These centers were usually attached to a casualty clearing station, and were manned usually by one ophthalmologist, occasionally more. During quiet times, the ophthalmologist in charge carried on his clinic and did a certain amount of refraction. He treated cases of disease, and, in general, cared for the eye work of the army area. He had a certain number of beds for emergency operations and for those cases where a few days' treatment was likely to enable the man to return to his unit without being sent down to the base. In active periods, he did his best to cover the operative and consulting work of his area. But in times of stress most of the eye cases were sent down to the base, except where the patient had other injuries and could not be evacuated. In very active times, the pressure on the casualty clearing stations was so great that only the more urgent cases could be operated on; there were also many hospitals to be covered in the army area, with the result that a large part of the eye work in the front area was done by the general surgeon. Most of the eye cases uncomplicated by other wounds were, therefore, quickly sent down to the base. As the British territory, especially in the north, was a comparatively narrow strip, the hospitals along the coast in times of pressure acted as casualty clearing stations and evacuated cases quickly to England.

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[1] Part of paper read by invitation before Section on Ophthalmology, New York Academy of Medicine, March 17, 1919.

There were three principal eye bases in France—Boulogne, Étaples, and Rouen. Of these, Boulogne was the largest, and it remained the headquarters of Colonel Lister throughout the war. The Boulogne eye base was established at No. 13 Stationary Hospital, one of the earliest hospitals in France, which later changed its name to 83 General. Here there were 132 regular eye beds, including 12 for officers in a separate ward. Extra beds could be obtained at the expense of the other services, if necessary. The arrangements at Étaples and Rouen were essentially the same. In addition to these three principal bases, there were subsidiary bases at Calais and at Havre, which were of less importance, and at which a smaller amount of eye work was done. Besides these five centers, there were various groups of hospitals which were situated more or less distant from an eye base. For each of these groups of hospitals an ophthalmologist was provided. The Boulogne eye base had 132 beds. There was a separate eye operating room and an out-patient department, which was exceedingly important and handled large numbers of cases, as did also the other two eye centers, Étaples and Rouen, for these three bases were important military centers in France. At Boulogne there were usually six ophthalmologists in attendance—Colonel Lister and his understudy and right-hand man, Major J. F. Cunningham, Captains Goulden and Whiting who did most of the operating for the eye clinic and looked after most of the ward work, and in addition there were usually two extra men who worked in the out-patient clinic. Colonel Lister made periodic visits to the other eye centers, and was on call throughout the B. E. F. At Étaples and Rouen each, there were usually three eye men.

Each of the three primary eye bases in France had an optical unit attached to it which supplied the lenses which were prescribed in the areas which they served. These in turn were supplied by the great army spectacle depot organized in London.

The ophthalmological service in France was run by a minimum number of men. I do not believe that all told there were more than 25 or 30 actually engaged in eye work, if we except the men who looked after the trachoma cases in the alien labor companies. Colonel Lister had great difficulty in getting men for his service.

Much of the eye work seen in France at the base was of the same type as the civilian eye work seen at home. The largest group of cases differing from those seen in civil life was formed by the "gassed cases." In July, 1917, we received our first convoy of cases affected by mustard gas. At this time, it was a new type of gas and no one knew anything about it. Lacrimatory gas, so-called, had only affected the eyes slightly and temporarily. With mustard gas we had respiratory signs and skin burns, and the eyes were affected in 80% of cases. The milder cases showed only a slight injection of the eyes, which cleared up very quickly. In the more severe, the lids were red and swollen and often there were large bullæ. There was intense photophobia and the lids were kept tightly closed. It was often necessary to cocainize the eye and to use lid elevators in making the first examination. There was marked conjunctival and ciliary injection, sometimes chemosis, and occasionally one saw a white œdema of the conjunctiva adjoining the cornea in the area of the palpebral fissure.

The cornea showed lesions of a varying degree, from a roughening of the epithelium to a well-marked band which extended across the palpebral fissure, and which was sometimes so marked that it could almost be distinguished across a wide ward. Corneal ulceration rarely took place and only when secondary infection set in, and a comparatively small number of eyes were lost or damaged. The gassed eye tends toward spontaneous recovery in a greater or less length of time. Proper treatment usually prevented the development of secondary infection.

In the treatment of mustard gas it is important to wash out the eyes as early as possible after the gassing with some mild alkaline solution, such as 1% bicarbonate of soda. Following that, the eye should be kept clean with irrigation with some bland collyrium, boric acid, salt solution, etc. As the affection represents a burn, oily solutions are well borne, and the best of these seemed to be liquid albolene. Theoretically, castor oil should be of value, as it is a vegetable oil and dissolves mustard gas. As a matter of fact, it proved more irritating than did the albolene. For the photophobia and ciliary irritation, atropin should be used to keep the pupil well dilated. In a number of cases a considerable quantity had to be used to accomplish this purpose. The eyes should be well protected from light, but a bandage is not permissible as it dams up the secretion. Secondary infection of the conjunctiva is best treated by some mild antiseptic like argyrol.

MAGNET WORK.—There was a large Haab magnet at each of the three principal stations in France—Boulogne, Étaples, and Rouen. In addition to this there was a Haab magnet mounted in a car, a so-called "mobile magnet," which it was possible to send from place to place as the occasion required. Magnet cases occurring in the front areas were evacuated to the bases, where the operation was performed. When the patient could not be moved, the mobile magnet was sent for.

Colonel Lister and many of his assistants were strong advocates of the anterior route for the extraction of foreign bodies from the eye. There are certain reasons which make it more advantageous in war cases. In the first place, magnet cases are seen most often when an action is taking place and there are a great many cases coming into the hospital. In such times it is very often difficult to get an X-ray. In active times the pressure on the X-ray department is tremendous. It is necessary to X-ray practically every surgical case. The localization of a foreign body in the eye requires a considerable amount of time, and to have it done in all but the best organized hospitals may mean a delay of a number of hours, and it is often impossible to hold cases for any considerable length of time in busy periods. Consequently, it not infrequently became necessary to go ahead on cases of suspected intraocular foreign bodies without an X-ray. Over 50% of foreign bodies in the eye in war times are non-magnetic, and it certainly is not desirable to make a scleral incision in a case where the foreign body may prove afterwards to have been non-magnetic. The general policy in the B. E. F. was to extract small foreign bodies through the anterior chamber even if the anterior segment of the eye were normal. Larger foreign bodies could be removed through the wound of entrance or through a fresh incision made in the sclera. Some men felt that they could make a fairly accurate localization of an intraocular foreign body by means of a small magnet placed on the sclera, but this was hardly general. At Boulogne the localization of intraocular foreign bodies by the X-ray was performed according to the McKenzie-Davidson method, but on account of the various difficulties X-ray localization was not used to a very large extent in my experience. Of course, the X-ray was more frequently used when extracting by the posterior route.

The technique of anterior extraction was beautifully carried out. The foreign body was drawn into the lower portion of the anterior chamber with the large magnet. For anterior chamber work a very small magnet made by Weiss and working on a storage battery was used. Corneal section from above was made. with a straight keratome. The foreign body was then drawn up to the wound by the magnet tip placed over it on the surface of the cornea. As the foreign body reached the wound the magnet tip dexterously separated the lips of the wound slightly and the foreign body was withdrawn, usually with the retention of a good anterior chamber. Only when the foreign body was entangled behind the iris have I seen the magnet tip introduced. As I said before, Colonel Lister and his assistants were very strongly in favor of the anterior route wherever it could be used. Unfortunately, we have as yet no statistics as to the results of these cases which were treated in the clinics of France. An attempt to work them up was planned, but was delayed by the German offensive of March, 1918. There were some 400 cases from the Boulogne Clinic available for the investigation. Final statistics should give valuable information as to the relative value of the anterior and posterior routes.

The writer brought over as a part of the eye equipment of Base Hospital No. 5 a small Lancaster magnet weighing about thirty pounds, which was about two thirds as powerful as the ordinary Haab. Colonel Lister was very much interested in this magnet, and set the machinery in action for designing and building some magnets of the same general type for his Service. About a year later, the British had begun to turn out magnets weighing 45 pounds, almost as powerful as the Haab, which they designed to place in some of their casualty clearing stations to be used by the ophthalmologist in charge of the eye center. The war ended before these plans were fully matured. These magnets were especially well designed, as they could work with full efficiency on either the 110-volt or the 220-volt current. Colonel Lister felt very strongly that magnets should only be handled by those thoroughly familiar with their use.

The most frequent operation which is performed in war cases is, of course, enucleation. As a rule, the British performed the Lister scleral frill operation, feeling that this procedure lessened the dangers of meningitis. In a certain number of cases, after a clean enucleation a glass ball was implanted in Tenon's capsule. Quite often one saw destructive lesions in which the eyeball was pretty well torn to pieces, and the removal of all the fragments from the lacerated tissues was a painstaking task. Foreign bodies in the orbit were common, and when the eye could be retained it was felt that the foreign body was best left alone, unless large or causing symptoms. To find a small foreign body in the orbit even with the help of an X-ray is often exceedingly difficult, and even after enucleation it is often not too easy. Through and through perforation of the eyeball was common, and it was often a nice question of judgment as to whether the foreign body was in the eye or in the orbit. We were often helped in the diagnosis by a definite, if somewhat slight, exophthalmus which was almost invariably present. I call to mind two cases where a small foreign body was protruding from the posterior sclera and yet where there was a definite exophthalmus.

There were frequent cases of laceration of the lids and of the orbital walls and tissues which required painstaking cleaning up and repair. In my experience, the British seldom used the conjunctival flap to cover ocular wounds.

Metastatic infections of the eye and more rarely of the orbit were occasionally seen. Curiously enough, all the cases which came under my observation originated from septic wounds of the femur with compound fracture.

As our hospital had a very strong group of brain surgeons, with Colonel Harvey Cushing at the head, we had a large number of head cases referred to us. A large number of these were examined ophthalmoscopically at varying periods of time after the injury, and in a very small number was an outspoken optic neuritis present. In a considerable number there was blurring of the disk margins, hyperæmia, and absence of the physiological cup; but as all these appearances may be present in a normal individual, it is exceedingly difficult to say what should be and what should not be regarded as pathological. A number of interesting fields were seen following injuries to the occipital lobe, hemianopsias, and homonymous quadrant defects with the interesting homonymous scotomata which have been so fully described by Marie and by Chatelin, also by Lister and Gordon Holmes.

One saw a large variety of all types of concussion injuries, a number of cases of hole in the macula, and a few cases of evulsion of the optic nerve. Neuropathic disease of the eye, usually a superficial punctate or a dendritic keratitis, was extraordinarily common.

Practically no plastic work was done in the B. E. F., as the cases were held too short a length of time.

The out-patient clinic was a very busy place, and large numbers of cases were handled there, as Boulogne was an exceedingly important military base. Much of the work done there was of the sort that the men at home are familiar with, except that with the British it was the fourth year of the war and England was being combed for men of all kinds, the result being that we ran across an abnormal number of disabilities.

At the time I was working with Colonel Lister there was almost an epidemic of night blindness in the British Army; not a week passed that we did not see a number of men complaining of faulty vision after dark. There were not a few cases of retinitis pigmentosa and choroido-retinal disease. A number of men had corneal scars or high errors of refraction. Others were getting used to going around in the dark for the first time in their lives. A few undoubtedly suffered from true night blindness without discoverable disease in the fundus and with normal fields. Many of these men were neurotics or malingerers. The ordinary tests were unsatisfactory. We gave them a careful examination, and if there was no discoverable defect, the customary procedure was to return them to duty with a note asking that they be put under observation. Very few of these men came back to us.

An interesting and splendidly organized department of the Eye Service in the B. E. F. was the handling of the trachoma problem among the alien labor companies. There were several thousand Egyptians of whom 19% had trachoma, and upwards of 100,000 Chinese 9% of whom were affected. The Egyptians were sent home in 1917. The Chinese were examined at Chinese headquarters by experts, and, as far as the eyes were concerned, were divided into three groups—first, those with clean eyes, the X group; secondly, the conjunctivitis or Y group; and thirdly, the trachomatous or Z group. They were then formed into X, Y, or Z companies of five hundred men each and were sent out, care being taken when possible to send the Y and Z companies to an area where they could be under the care of a medical officer with experience in ophthalmic work. All clean companies were treated with zinc drops as a routine, and appropriate measures were taken for the treatment of the conjunctivitis and trachoma companies. Periodic inspections were carried out. This work has been described in detail by Major J. F. Cunningham in the *Transactions* of the Ophthalmological Society of the United Kingdom for 1918.

I was very much impressed by the excellence of the eye work done in the B. E. F. Colonel Lister had an exceedingly well-trained staff and the work reached a very high standard. Much of this was due to his own personality and his unfailing zeal.

I do not propose to talk about the organization of the Eye Service in the A. E. F., as that is shortly to be described in a paper by Lt.-Col. Greenwood, Senior Ophthalmic Consultant. There are, however, one or two points which I would like to refer to. In the A. E. F. towards the end of the summer campaign, it became possible to station an ophthalmologist in most of the front line hospitals. This was done by Colonel Greenwood, as it was felt that every man with a wound of the ocular structures should be able to obtain expert advice at the earliest possible moment.

As the result of my experience, I feel strongly that eye work should be done by the specialist. Enucleation is an easy operation, but it is surprising to see how badly it is often done by the general surgeon, and how much tissue is removed which should be left if a proper stump is to be retained. The extensive and thorough débridement of wounds—so urgent in general war surgery—does not apply so stringently in wounds of the face, where the blood supply is good, and yet we saw cases where complete débridement of the eyelids was performed, with the horrible resulting deformities. One cannot too energetically impress the necessity of saving every possible bit of tissue in lacerating wounds of the lids, conjunctiva, and orbit, and the most careful repair of these wounds should be performed as early as possible. Wounds in this region, especially where the nasal cavities are not opened—in contradistinction to wounds of other parts—may be closed with the exception of a small drain in the corner. The packing of the orbit after enucleation, often practiced by the general surgeon after removal of the eyeball, is of course unnecessary. The general surgeon does not realize the necessity of removing every fragment of the shattered eyeball, often a very difficult procedure. In many cases it is quite difficult to decide whether or not an eyeball should be removed at the primary operation. The earlier a foreign body can be removed from the eye, the better is the chance for retaining a certain amount of sight. The criticism of the eye work done by the average general surgeon, according to my experience, applied equally to the B. E. F. and to the A. E. F.

In conclusion, I wish to make my acknowledgments to Colonel Lister, Major Cunningham, and the other members of the Staff for their great kindness toward me and for the many opportunities they gave me of observing and taking part in their work.

EXPERIENCES IN REPARATIVE SURGERY AFTER WAR INJURIES OF THE EYES.[1]

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LATE CAPTAIN, M. C., U. S. A.

(*With fifteen illustrations in the text.*)

THE question of late repair work in military surgery is one that will be of interest to the surgeon for some time to come. While it is the intention of the army to have all men return to civilian life in the best possible condition, it is certain that many of them, especially those with eye injuries, will be discharged before the reparative work is completed; leaving the balance to be finished at some of the hospitals in the larger cities. As many of these cases cannot be cured by a single operation, and others have been operated on with no success, the men are certain to be anxious to get home and to choose the time of the second operation rather than remain in some military hospital. As most of this work is elective many of the soldiers will defer the operation until they return and are mustered out of service.

The problem of late restorative work on the eye is fully if not more difficult to solve than that of the earlier period. The operation that was originally performed must be repeated, owing to failure on the first attempt, with the difference, however, that scar tissue has formed, which lends an entirely new phase to the matter. There may be some question as to the reason for the large amount of late repair work; this can be explained by the fact that in most injuries to the body, other than those of the head, there is an extensive débridement of the wound before closure; this to a certain extent insures primary union by removing the dead and infected tissues. In cases of head injuries the débridement is of necessity less extensive and the result is that primary union is not as often obtained as might be desired.

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[1] Read before the Section on Ophthalmology, New York Academy of Medicine, March 17, 1919.

As to injuries received in battle, they do not vary greatly as to variety or extent, as compared with those at some large manufacturing or steel center. The number of cases seen is, of course, greater, and when a few cases of a certain injury are seen within a given period of time, a greater number will be seen at some eye center or base hospital. And going further, when a number of cases of a given type have been operated on by a certain procedure, and favorable results obtained, that method has been followed, modified, or combined with other operations, as necessity called for.

The hospital in which the plastic work is done usually receives its patients from a few weeks to several months after the injury has occurred. In the lighter cases where there has been little loss of tissue and the wound is clean, secondary sutures are taken in order to shorten the convalescence. In the more serious cases where the loss of tissue is marked, infection is present, or bone is involved, the patient is treated until the wound is completely healed before any plastic work is attempted. Usually three months is necessary to produce complete contracture of the scar and cases operated on before that time do not give the best result. As most of the patients are hardy and generally in good condition physically, the operations are usually done under local anæthesia. If the patient is of a nervous type and fears the operation a quarter of a grain of morphine is given subcutaneously one half hour before the operation. The following solution:

Novocain	0.1 *gm.*
Adrenalin (1:1000)	2.0 "
Distilled water	10.0 "

is used to produce local anæsthesia, and as much as 10*cc* of the solution can be injected without producing any unpleasant effect.

It is only seldom that a general anæsthesia is required as most of the work is for cosmetic purposes, and the patients are willing to bear a little pain rather than to suffer from the after effects of the anæsthesia.

The only local preparation that the patient receives before a plastic operation is a painting of the area to be operated on with the tincture of iodine. This is routine and even in cases where a small incision is made the surrounding area for some distance is covered with iodine.

In the postoperative treatment an attempt is made to remove the sutures, that are not sustaining sutures, as soon as possible, in order that the suture openings may close. In cases where an incision runs across the face every third suture is removed on the third day, on the fourth day every other one, and on the fifth the remainder. When the healing is complete gentle massage is begun in order to increase the mobility of the parts and to help reëstablish circulation in the operated area. This is kept up until all flaps become smooth and pliable and the wound incisions smoothed out.

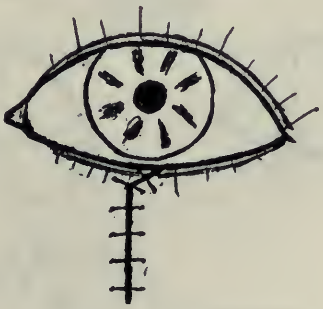

FIG. 1.—Coloboma.

Coloboma. Probably the most frequent of lid injuries is the coloboma. The repair of a coloboma which is not situated at the extreme ends of the lid offers no great difficulty even if there is considerable scar tissue present. First the edges are freed if adherent; trimmed; the scar tissue removed; and the wound closed. If possible the wound should not enter the intermarginal line at a right angle, but obliquely as indicated in Fig. 1. This increases the chances of a good result and even if the intermarginal suture fails to hold the notching of the lid margin will be slight.

If the eyeball is in situ, it is well not to cut the intermarginal suture short, but leave the ends about *2cm* long. After a coloboma operation there may be a slight tendency to entropion, and if the intermarginal knot has short ends there is a danger of producing an abrasion of the cornea; with the long ends placed under the dressing the lid is held in a better position and there is less danger of accident. In cases where the ends of the coloboma are adherent to the orbital margin, after freeing and placing them in position a pedunculated fat flap is taken from the cheek and placed over the exposed bone, then the coloboma is sutured. This fat flap prevents the edges of the wound becoming adherent to their old attachment and fills out the cavity formed by the loss of tissue.

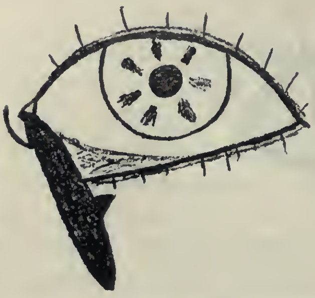

Fig. 2.—Coloboma, Blaskovics.

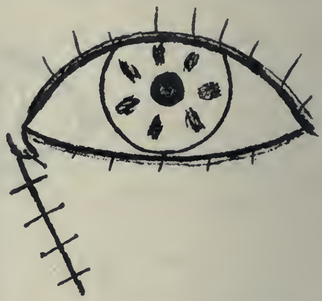

Fig. 3.—Coloboma, Blaskovics.

A coloboma of the inner canthus presents several difficulties. Usually the lid has been torn away from the attachment and anchored below in an ectropinized position. The result is that even after the lid is freed and brought into position it is not easy to suture it into a position that will produce a satisfactory adhesion. The Blaskovics operation (vide Archives of Ophthalmology for July, 1918) overcomes this difficulty.

The end of the lid is first freed by outlining the cicatrix and dissecting out all of the scar tissue; if this is thoroughly done the lid can be brought into proper position against the inner canthus. A small skin flap is then formed at the inner angle of the lid, about *5mm* in length (Fig. 2). An incision *4mm* in length is made in the lid parallel to the lid margin and about 4*mm* from it. The gaping of this wound produces a small triangular defect into which the flap dovetails on suturing the edges of the coloboma together (Fig. 3). By means of this small flap the end of the lid is held in contact with the canthus and even if the first suture fails to hold, this small spur of skin is strong enough to hold the lid in its new position.

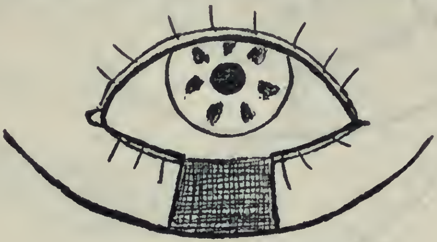

FIG. 4.—Coloboma, Blaskovics.

(Fig. 4.) A second procedure is suitable in cases where the coloboma involves the middle ⅓ of the lower lid and in which there has been some loss of tissue. The first incision is 1*cm* below and parallel to lid margin and extends the entire length of lid. Two incisions at right angles to lid margin are made connecting with the first incision. The scar tissue is excised and the edges of the coloboma are brought together and sutured, leaving a crescentic defect below (Fig. 5). This

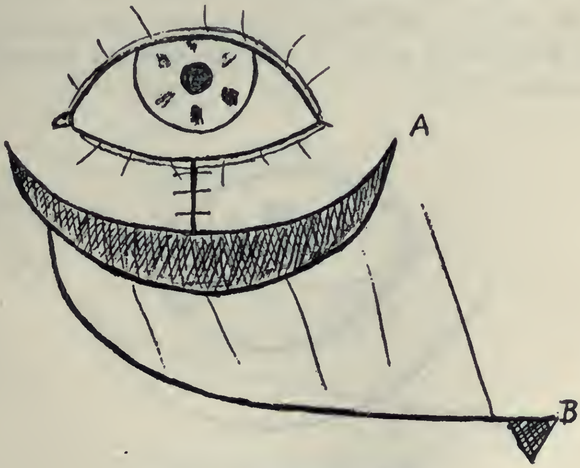

FIG. 5.—Coloboma, Blaskovics.

defect is covered by making an incision which runs from a point 1.5*cm* to 2*cm* from the inner horn of the crescent down and out on the cheek. A Burows triangle is made at the end of the incision and the pointed flap with subcutaneous fat is then dissected up as far as the line A-B and sutured in its new position (Fig. 6).

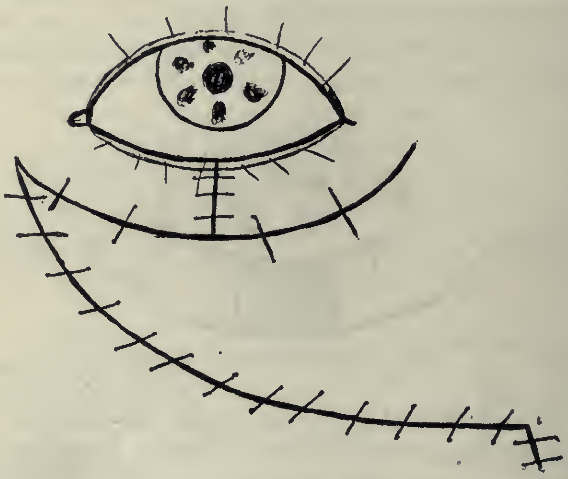

FIG. 6.—Coloboma, Blaskovics.

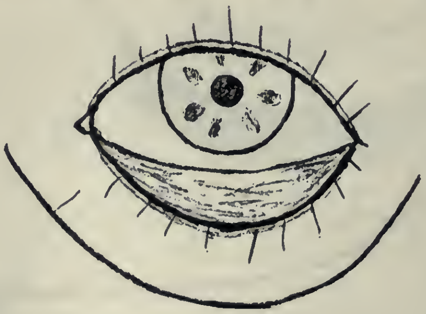

FIG. 7.—Cicat. ectropion.

While this operation was devised primarily for coloboma it developed that it gave good results in cicatricial ectropion (Fig. 7). In these cases after the first incision is made parallel to the lid margin, the skin between the incision and the lid margin is dissected up and scar tissue removed so that the lid is brought into position against the globe. The second incision begins at the inner end of the defect and runs down onto the cheek, ending in a Burows triangle (Fig. 8).

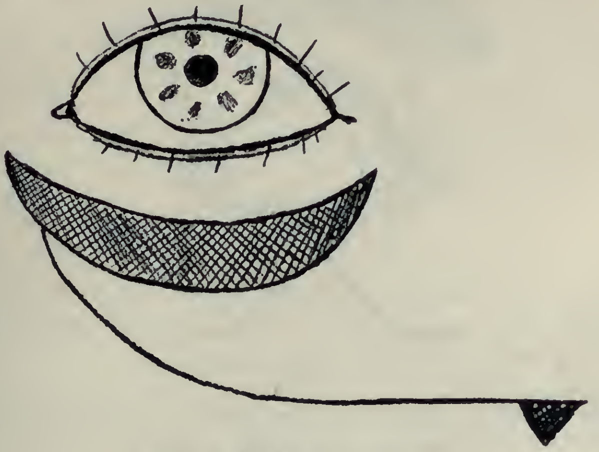

Fig. 8.—Cicat. ectropion.

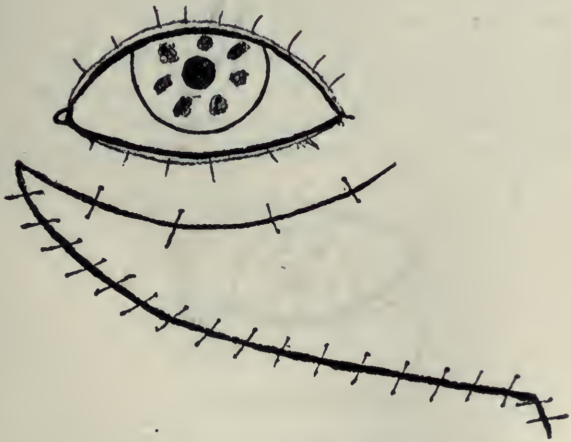

Fig. 9.—Cicat. ectropion.

The flap is then undermined as in the preceding operation and the defect covered by it (Fig. 9). The results from this operation were entirely satisfactory and it was generally employed instead of the Wolfe graft.

In cases where a central coloboma of the upper lid was associated with considerable loss of tissue a Wickeriewicz plastic was performed (Fig. 10). In this operation an inverted V-shaped incision is made through the entire thickness of the lid. The flap is then turned back on the cheek, and two horizontal incisions are made which connect with the base of the flap. The edges of the coloboma are freshened and as much scar tissue removed as possible. The triangular flap is then drawn up into position and its edges sutured to the edges of the coloboma. In this manner the defect in the upper lid is closed by the pedunculated flap from the lower. One week following this operation an incision is made through the base of the flap freeing the upper from the lower lid; the triangular flap by this time forming an integral part of the upper lid. This operation however was only attempted in several instances as the scar formed on the lower lid was so disfiguring that the Landolt plastic was substituted when possible (Fig. 11). In the Landolt plastic when the coloboma

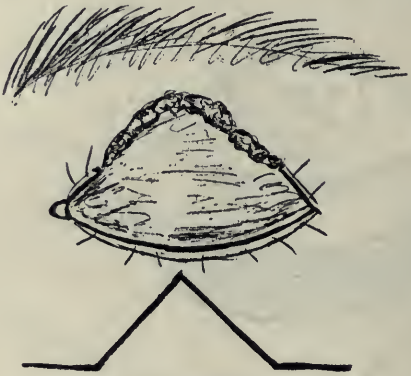

Fig. 10.—Wickeriewicz.

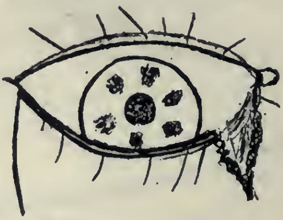

Fig. 11.—Landolt.

involves the inner third of the lid, its edges are trimmed and an intermarginal incision extending to the outer canthus is made. From here a curved incision extends upward for a distance of 1.5*cm* to 2*cm*. The intermarginal incision is then deepened until the lid is split into two parts. The quadrangular skin flap thus formed is slid over the defect in the lid and sutured into position (Fig. 12). The secondary defect is covered later with a Thiersch graft.

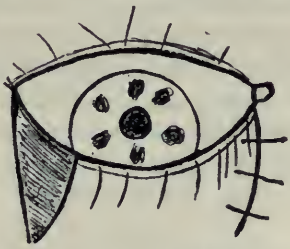

FIG. 12.—Landolt.

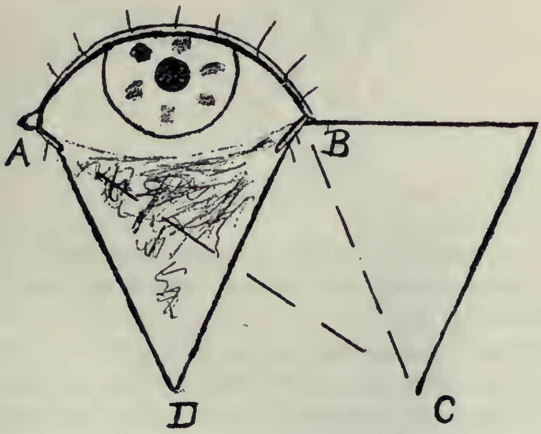

FIG. 13.—Dieffenbach.

The condition which gave the most trouble and where the results were not highly satisfactory was the total loss of the upper lid. Here an attempt was made to produce a new lid by means of a pedunculated flap. A lid was constructed but without musculature. Most of the patients were satisfied if they were able to retain a glass eye in place. This was accomplished but beyond that not much can be said. The production of a new lower lid was not so difficult and from a cosmetic standpoint more of a success. This was accomplished by means of a pedunculated flap or by a modified Dieffenbach (Fig. 14). One of the defects of the original Dieffenbach operation is that when the flap is sutured in its new position it is on the stretch, that is the line B-C is shorter than line A-C (Fig. 13). This is corrected in the modification of the operation by placing the point C below the midpoint of the lid, the line B-C then being a little longer than the line A-C.

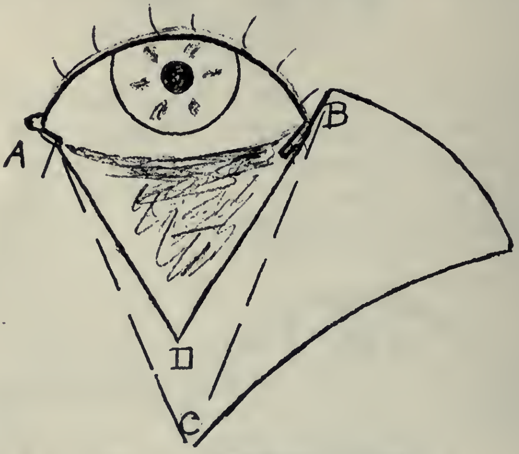

Fig. 14.—Dieffenbach modified.

By this slight change the flap is made to rotate into its new position and to cover the primary defect without being on the stretch (Fig. 15).

Enucleation. In regard to operations on the globe there is little to be said outside of enucleation, as most of the eyes had either been saved or lost before the patient arrived for his plastic work. As to enucleation there are a few points that may be brought out. First in all cases when the globe had not been too badly injured the enucleation was done under local anæsthesia. This was produced by giving three retrobulbar injections of 2*cc* novocain-adrenalin solution. The first injection was made through the outer canthus, the second and third at the junction of the inner and middle ⅓ of each lid respectively. The needle in each case passed through the skin and was pushed back towards the optic nerve, hugging the globe as closely as possible. One half of the syringeful was injected near the nerve, the syringe was then slightly withdrawn and the balance was injected in an attempt to block the ciliary nerves. If the injection was properly given proptosis followed owing to some of the solution passing into Tenon's capsule. A half hour was allowed to elapse and then the eye was removed; seldom did the patient complain of pain.

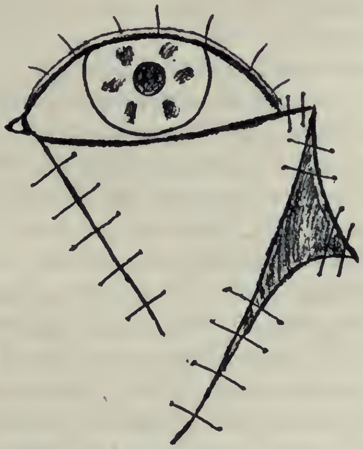

FIG. 15.—Dieffenbach modified.

In cases where the eye had received a severe trauma and ruptured, the enucleation was done under a general anæsthesia. In many instances the globe did not rupture at one but several points, scleral tags being driven into the orbital fat. It sometimes happened that these cases were seen by a medical officer who had had no ophthalmic training, an enucleation was attempted, part of the eye removed, and the patient came back to the base hospital with anophthalmos written on his history. Later on it was discovered that something had been left behind in the orbit; the patient complained of pain, and a second enucleation was started. The conjunctiva was then opened and the shrunken globe grasped and dissected out of its bed. The freeing of the anterior portion of the bulb offered no difficulties but the posterior portion required care. In working toward the optic nerve every snip of the scissors was carefully made. If any resistant tissue was found between the blades they were not closed near the globe, but were pushed out toward the orbital wall and closed there. This was done in order to avoid cutting some of these scleral tags. In this manner the shrunken stump was encircled and the enucleation completed. Following this a digital examination was made of the orbit to make certain that no foreign body, bone fragments, or scleral tags were left behind. Out of approximately three hundred enucleations no cases of sympathetic ophthalmia were seen; some of the enucleations being performed two years after the injury.

In these late enucleations it is seldom that the conjunctiva can be sutured. Usually a considerable portion has been lost at the time of the injury and that part that is left behind after the complete enucleation is so short that suturing is not attempted. In order to prevent adhesions and contractions, as far as possible, a drainage or reform eye is inserted and worn for some time. This helps to prevent contraction of the socket, and in many cases an operation for restoration of the cul-de-sac is avoided. When this procedure was found necessary Weeks's operation was resorted to. In some of the cases the result was not satisfactory, part or all of the graft failing to adhere; the failures, however, were in orbits where the scar tissue was very dense and a suitable base for the graft could not be obtained. In two cases where the result was negative a permanent blepharorraphy was performed. This can hardly be called a cosmetic operation, but it was not as disfiguring as might be expected as the patients were both badly scarred around the orbit and cheek.

Epithelial Inlay of Esser. In addition to the Wolfe graft implantation, another method of skin grafting has proven successful in cases of retracted lids and that is the method of Esser of Amsterdam, which consists of producing a pocket lined with epithelium. In cases where the lower lid is involved and the fornix is to be deepened a cutaneous incision is made along the orbital margin and carried down to the conjunctiva. All scar tissue is then removed, care being taken not to cut the conjunctiva. The hemorrhage is then checked and a mold is made to fit the cavity out of a dental composition. This mold is then covered with egg albumin and a Thiersch graft pasted on it, the epithelial side against the mold. It is then buried in the cavity and the skin wound is sutured. At the end of ten days an incision is made through the conjunctiva down to the mold which is removed through the opening. On removing the mold there will be found a cavity which is lined with epithelium. A prothesis is immediately inserted into the cavity to prevent the adhesion of the wound edges and to retain the shape and size of the cavity. In this manner the fornix is deepened by means of this epithelial cavity or inlay.

Epithelial Outlay of Gilles. Gilles of London on the basis of this method of skin grafting developed what he calls an epithelial outlay, in contradistinction to Esser's inlay, as a procedure for the correction of cicatricial ectropion. In cases of involvement of the upper lid, an incision is made parallel to the lid margin and 5*mm* behind it. This is deepened until the tarsus is reached, care being taken not to injure the levator. The strands of scar tissue that are present are excised and the edges of the wounds are undermined, especially above, thus allowing the lid margin to descend to its normal level. A mold is then taken of the cavity, which is covered with an epithelial graft as described in the Esser method. This is then placed in the cavity and the skin sutured over it. Following the suturing the ectropion is more pronounced for the time being, *i. e.*, until the mold is removed. Gilles advises against closing the wound too tightly as this prevents the epithelium growing around the wound edge to the epithelial graft. After the tenth day the mold is removed through the original incision and the lid drops to its normal position. The ectropion is cured by operation but it takes some time for the edges of the new epithelial area to smooth out.

A CASE OF ACUTE RETROBULBAR NEURITIS IN A BABY.

By T. HARRISON BUTLER, Birmingham, England.

THE case of retrobulbar neuritis in a baby published in the Archives, January, 1919, by Dr. Schoenberg leads me to record a somewhat similar case.

> On January 4, 1919, a boy aged 1 year 5 months was brought to my consulting rooms.
>
> The history is as follows:
>
> The child was perfectly normal till six weeks ago, when he appeared to be feverish and had a slight convulsion. Soon after the mother noticed that the child who could walk began "to fumble about the house" and to be unable to avoid objects. In a few days she concluded that her baby had become blind. Examination showed that the pupils did not react to light, and that the infant could not see. Both disks were pale, but the vessels were normal in size. The disk edges were perfectly sharp. The boy, the first-born, appeared to be thoroughly healthy. His mother had had no miscarriages, and there was nothing suggestive of syphilis in the parents or child.
>
> The primary attack occurred when influenza was prevalent in the town in a virulent form accompanied by many rapidly fatal cases of pneumonia.

A diagnosis was made of optic atrophy secondary to acute retrobulbar neuritis possibly caused by influenza. Congenital blindness, generally due to syphilitic optic atrophy in an infant who had previously enjoyed good sight, has never before come under my notice, and must be rare. Peters, in *Die Erkrankungen des Auges im Kindesalter*, gives little information upon the subject, only suggesting that such conditions are generally early symptoms of disseminated sclerosis.

I am inclined to think that in my case the neuritis was of influenzal origin. During the recent epidemic I have seen several examples of the ravages of influenza upon the eye, among them the following case:

> A man was admitted to the Birmingham Eye Hospital for preliminary iridectomy. He left the institution with a good coloboma, and an eye free from any injection. As soon as he got home he was attacked with a severe variety of influenza, and his eye became violently inflamed. Fourteen days later he reappeared at the hospital with the eye in a state of panophthalmitis and it was removed. Owing to an unfortunate mistake no bacteriological examination was made.

There was no actual evidence that the baby had suffered from influenza, but it is quite possible that the retrobulbar neuritis may have been of this nature. There was no history of any gastrointestinal derangement and the child was bright, active, and healthy.

At the moment of writing, three months from the onset, I have had no news of any return of sight, and I fear that there is now little hope of improvement.

TUBERCULIN IN THE DIAGNOSIS AND TREATMENT OF EYE DISEASES.[1]

By ERVIN TÖRÖK, M.D., New York.

THE first observations of tuberculosis of the eye date from the beginning of the past century, when surgeons, dissecting the bodies of persons who had died from acute miliary tuberculosis, found the choroid containing tubercles.

Jaeger was the first ophthalmologist who, in 1855, by the use of the ophthalmoscope, saw them in living persons. At that time, however, the knowledge of tuberculous affections of the system at large, as well as that of the eyes, was only vague, and the general problem of tuberculosis did not attain any importance in medical science until the wonderful works of Virchow (1865) and, later, those of Langhans, Schüppel, Baumgarten, and others, established the pathology of the disease. A further advancement was made in this subject when in 1868 Willemin discovered that tuberculosis could be transmitted by inoculation to certain animals; and, finally, when in 1882 Robert Koch found the bacillus of tuberculosis.

These investigations and discoveries are those which form the foundation on which our present knowledge on this subject is built.

As in all other subjects of medicine, so in the tuberculous affections of the eye, two points are of the utmost importance from a practical point of view, and these are: the making of a proper diagnosis, and the applying of the treatment which promises the best results; and these are the points which will be dealt with in this paper, based on our clinical experience at the Knapp Memorial Eye Hospital, covering a period of about fourteen years.

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[1] Read at meeting of Section on Ophthalmology, New York Academy of Medicine, February 17, 1919.

In diagnosing a certain eye condition as tuberculous, the following points are usually taken into consideration:

(1) age, (2) previous history, (3) family history, (4) examination of system at large, (5) animal inoculation, (6) demonstration of the presence of the tubercle bacillus, (7) microscopical examination of an excised portion of diseased tissue, (8) tuberculin injections, (9) clinical appearance of the diseased eye.

As to the age of the patient, previous history, and family history, these are important points which have to be taken into consideration when a diagnosis of tuberculosis is made; none of them, however, is such that much reliance can be placed upon it.

It is true that tuberculosis usually occurs among younger individuals; but, on the one hand, an infection with tubercle bacilli may, and quite often does occur in older people; and on the other hand the condition being usually chronic, the patient may come under observation several years after the onset of the disease and often cannot give us the proper information as to the beginning of his trouble. To determine from the appearance of the eye whether the condition is of two or three years' duration, or ten to fifteen, is, in many cases, impossible.

As to tuberculosis of other organs, this also cannot be considered of great importance from a diagnostic standpoint, because if there is tuberculosis somewhere in the body it does not follow that the eye condition is of the same origin; then again, in the greater percentage of undoubtedly tuberculous eye trouble, no tuberculosis of any part of the system at large can be found.

I have in mind the case of a young woman who had tuberculosis of the lungs (she is at Saranac Lake at present) who also showed Wassermann reaction; both eyes were affected by an interstitial keratitis. She gave strongly positive tuberculin reaction to 0.001 T. V. general, with high temperature and the usual general symptoms, but no focal reaction, and whose eye cleared up promptly under anti-luetic treatment.

As to the inoculation into animals: the demonstration of the presence of the tubercle bacillus, and the microscopical examination of an excised portion of the diseased tissue, these can occasionally be resorted to in cases of eye diseases. It is possible to make such an examination if the lacrimal apparatus, eyelids, conjunctiva, or the sclera is affected. It is possible, also, sometimes on rare occasions, when operative interference is indicated, in cases of affections of the iris. One such case was of scleritis and sclerosing keratitis where a secondary glaucoma developed and an iridectomy had to be performed. In this latter case a pure culture of tubercle bacilli developed from the contents of the anterior chamber.

In cases of corneal affections and also those of the background of the eye, however, these examinations cannot be resorted to. Then again we have to take into consideration that the microscopical findings are not always typical; that inoculations into animals, even in a case of positive tubercular condition, may be negative, if there happened to be too little or no virulent material in the excised tissue; and, finally, that the finding of the tubercle bacillus is in most of the cases a long and tiresome procedure; and that there are the so-called pseudo-tubercle bacilli which resemble the real tubercle bacilli in every respect, so that experienced bacteriologists are unable to distinguish between them.

I wish to refer here to a case published by Axenfeld and Peppmueller, in which there were no bacilli in 120 sections made of a tubercular abscess but bacilli were found in the following sections, and they were found only after the 50th section in an epibulbar tumor which occurred in the same person.

From a practical standpoint, therefore, the most important factors in making the diagnosis of a tubercular affection of the eye are: the clinical appearance of the eye and the tuberculin injections.

The clinical picture of tubercular eye affections is pretty well defined at present, so that there are quite a few conditions which a priori lead us to suspect a tubercular origin. These conditions are well known and it does not seem necessary to go into it further. I only wish to point out that all these conditions are generally characterized by their chronic course, low inflammatory symptoms, and the appearance of small nodules (tubercles) in the affected tissues. Among these characteristics the nodules are of the most importance, as their presence seems to be considered an almost positive proof of a tubercular affection. They may be present in the beginning of the disease, or they may develop some time during its course, or following a diagnostic injection of tuberculin. They may present themselves on the affected tissues of the eye or on another tissue which is in close connection with the former but not affected. We have had a few very interesting observations on this point.

Take, for instance, one patient who came under observation with a typical interstitial keratitis, and in the seventh week developed scleritic nodules; and, as a contrast, another patient who was admitted to the hospital for diagnostic tuberculin injection. This patient was suffering from a typical scleritis with scleritic nodules and beginning sclerosing keratitis, which later disappeared, and then a typical interstitial keratitis—not a sclerosing keratitis—developed in the eye.

We also had under observation a case of iridocyclitis with no nodules on the iris, which later developed nodules on the sclera; and another case which, in 1913, was treated for an interstitial keratitis, and then returned, in 1915, with an iritis, and later, also developed nodules on the sclera.

All these cases proved to be positively of tubercular origin, showing from a clinical standpoint the importance of the nodules, and also the close relationship between cornea, sclera, and uveal tract, at least as far as tubercular affections were concerned. It seems that the inflammation of all three tissues is usually present in every case of interstitial keratitis, iridocyclitis, or scleritis; the name of the disease being applied according to which tissue seems to be most involved, from a clinical standpoint, at the time of examination. It also appears that the prevalence of inflammatory symptoms may change during the course of the disease: thus, from a clinical standpoint, a scleritis may change into an interstitial keratitis or iridochoroiditis and vice versa; also that a sclerosing keratitis is nothing but a not fully developed interstitial keratitis, which occasionally may develop into a clinically so-called interstitial keratitis. The difference between them may lie in the difference in virulency and severity of infection. The seat of infection is probably in the uveal tract, an idea expressed and demonstrated by pathological findings by Treacher Collins, in 1907.

Although the presence or temporary appearance of these nodules is highly suggestive of a tubercular affection, their absence does not disprove such an origin. Clinical experiences, as well as animal experiments and pathological examinations of enucleated eyes, have shown that there is a number of conditions which clinically do not appear to have any characteristic tubercular symptoms, except their chronic course, which are of undoubtedly tubercular origin.

I wish to refer here especially to Stock's experiments and investigations. Stock (Graefe's *Archiv für Ophthalm.*, lxvi.) succeeded in developing various forms of eye diseases by injecting tubercle bacilli into the vein of the ear of rabbits. The disease which he found as a result of this injection was, in the greater number of cases, similar to the chronic iridochoroiditis of human eyes, with and without the appearance of nodules. He, however, also observed cases similar to disseminated choroiditis, scleritis, and tuberculosis of the conjunctiva. Finally, Stock also found that in making careful histological examinations of eyes which were enucleated for chronic iridochoroiditis that a great many of these cases were of tubercular origin, although, in vivo, they showed no signs which would have been suggestive of tuberculosis.

So we find that the clinical appearance of the eye is not always reliable in suggesting tuberculosis, and not absolutely reliable in establishing our diagnosis. To confirm our diagnosis, whether the case is clinically suggestive of tuberculosis or not, we resort to tuberculin. There are three methods of using tuberculin for diagnostic purposes: The Calmette or eye reaction; the von Pirquet or cutaneous reaction; and the subcutaneous tuberculin injection. The tuberculin generally used in all three of these methods is Koch's T. V.

The Calmette reaction consists of dropping 1 drop of a 1% solution of T. V. into the conjunctival sac. In case of an active tubercular process in the system, a severe reaction sets in in the eye. This reaction is especially severe if the eye itself is suffering from a tubercular affection, and has, in our experiences as well as the experiences of others, resulted at times in very severe and irreparable damage to the eye. The use of tuberculin, therefore, in this form, has been absolutely abandoned.

The von Pirquet cutaneous reaction is secured in the same way as in vaccination: by using a 25% solution of T. V. In case of a positive reaction, the skin at the site of the inoculation shows the well-known characteristic changes. This method has been found to produce a highly sensitive, positive reaction, not only in cases of active tubercular processes, but also in old, healed ones. Since there are very few adults who are absolutely free from old tubercular foci somewhere in the body, this reaction is at present almost exclusively used in children. The method, however, only informs us of the presence or absence of a tubercular focus in the body of the patient, but gives us no clue whatsoever as to the location of this focus. The eye condition, in case of a positive reaction, may or may not be of tubercular origin.

Much more reliable and valuable is the subcutaneous injection of T. V.

The subcutaneous method consists in injecting T. V. under the skin. This method is well known and need not be described here. It is absolutely void of danger, at least so far as our experiences go, comprising almost 1000 injections. We use it in preference to the von Pirquet reaction, in every case in which we suspect a tubercular origin, children included. The amount injected is ½*mgm*, 1*mgm*, and 3*mgm* in children; and 1*mgm*, 3*mgm*, and 5*mgm* in adults. If, after 3*mgm* in children and 5*mgm* in adults have been injected, we do not get a positive reaction, the patient is considered free from tuberculosis.

A positive reaction consists in local, general, and focal reaction.

The local reaction is the one we observe at the site of injection, usually on the arm. The skin at this point becomes, within a rather circumscribed and sharply defined area, red, swollen, hot, and quite sensitive. This change, in our opinion, is more or less equivalent to the von Pirquet cutaneous reaction, and its meaning, in our interpretation is, that there is a tubercular focus somewhere in the system. The intensity of this inflammatory skin reaction may indicate the activity of the focus, it probably being smaller and less intense if the focus is old and less active and vice versa. A local reaction alone, therefore, in our interpretation means that there is a tubercular focus somewhere in the system; but means nothing as far as the eye is concerned.

The general reaction consists in a rise of temperature, general malaise, headaches, and heaviness of the limbs. The rise of temperature usually occurs within 24 or 48 hours after the injection, and consists of a sudden rise and sudden fall of temperature; it often being subnormal for a while afterwards. The rise of temperature is not as important as the characteristic sudden rise and sudden fall; it should, however, be at least 1°F. The general reaction in our interpretation has approximately the same meaning as the local reaction, *i. e.*, that there is a tubercular focus somewhere in the system.

It is perhaps safe to assume that the smaller the dose of tuberculin, the higher the rise of temperature; and the more pronounced the general malaise, headaches, and other symptoms are—the more active and perhaps larger is the tubercular focus. This reaction, however, as in the case of the local reaction, does not indicate the location of the focus.

The focal reaction always manifests itself by an increase of inflammatory symptoms in the eye; or, occasionally, the appearance of nodules. It is often very difficult to observe, and only the closest observation of the eye will reveal its appearance. This is particularly true in cases of tuberculosis of the conjunctiva and cornea. In diseases of the choroid, retina, or optic nerve, we found it to be of great service in detecting a focal reaction to make a rough sketch of the fundus immediately before the injection is given, and then to compare this with the condition that is present during, or immediately after, the general reaction. Often very slight changes can be detected in this manner which otherwise would surely be overlooked, and a positive focal reaction be considered negative.

This reaction is the most important one, and the only one which, from our experience and according to our interpretation, indicates that the tubercular focus is in the eye; or, in other words, that the eye condition is of tubercular origin. We, therefore, term an eye condition tubercular only if a positive focal reaction has been observed. There are, however, cases where it is impossible to detect a focal reaction.

Take, for instance, the cases of recurring, juvenile hemorrhages, of which we had one case under observation, where, on account of the hemorrhages the fundus was not visible; or take the case of a young woman, 22 years old, who suffered from an unusual form of acute retrobulbar neuritis. This latter patient, whose case will be published in the near future, has had an acute retrobulbar neuritis in the left eye. She was an inmate of the Neurological Institute, where her system was most thoroughly examined and every test was found negative. She then was transferred to the Knapp Memorial Hospital, where the usual treatment of pilocarpine sweats, K. I., etc., was given. In spite of this treatment, however, the left eye remained blind, and after two or three weeks' treatment she began to complain of dimness and cloudiness in her right eye.

This condition slowly increased and in five or six days resulted in total blindness, with dilated pupil, which did not react to light; and the usual slight neuritic changes in the optic nerve. A tuberculin injection was now given, and to 3*mgm* we obtained a marked general and local reaction; but no focal reaction could be observed. Tuberculin treatment was then commenced, under which she slowly recovered; regaining $\frac{20}{20}$ vision in each eye. It is now two years since the treatment was discontinued and she is still perfectly well, having had no relapses.

Now in cases like both of these, where we get a general and local reaction but for one reason or another no focal reaction can be observed, the diagnosis of tuberculosis cannot be positively established. Our procedure in these cases is to make a most thorough examination of the system at large. If there is no other cause found which would account for the eye trouble, and at the same time no focus found in the body which would explain the positive general and local reaction, we consider the eye condition probably of tubercular origin.

The cases reported here number 100. There are 37 males and 63 females.

The age of patients is as follows:

1 – 10	4
10 – 20	32
20 – 30	32
30 – 40	25
40 – 50	7

As to diseases the cases are divided as follows:

Scleritis and sclerosing keratitis	21
Interstitial keratitis	8
Deep keratitis	9
Chorioretinitis	3
Choroiditis disseminata	4
Exudative choroiditis	11
Iridocyclitis	12
Iridochoroiditis	8
Heterochromic cyclitis	5
Periphlebitis retinæ	11
Detachment of retina	5
Tuberculosis of optic nerve head	1
Tuberculosis of conjunctiva	2

As to the tuberculosis of conjunctiva cases: both of them showed positive focal reactions, and both of them were under observation for several years (6 and 4 respectively). The condition of the eye in both cases was the type closely resembling trachoma. Under tuberculin treatment the follicles disappeared; the pannus has been absorbed and the eyes are now free from inflammation; the conjunctiva is smooth. We observed no relapse in these cases, both of them being under continuous treatment since they came under observation. The treatment during this time was an injection once in 3–4 months.

Eight cases of interstitial keratitis are here reported; they were under observation from 2 to 5 years. All eight cases showed positive focal reaction to tuberculin; three of them had also a positive Wassermann reaction. These latter three cases were first submitted to anti-luetic treatment, and tuberculin was resorted to for diagnostic and therapeutic purposes only after anti-luetic treatment had failed to produce results. All eight have recovered and no relapses have been observed; the treatment lasted from eight to fourteen months.

The deep keratitis cases number nine: all of them showed a positive focal reaction. They were under observation from 2 to 7 years, with the exception of one who recovered after seven months' treatment, and then the patient disappeared. Of the remaining 8 cases, 7 have recovered; of which 3 have had several relapses. The treatment in these cases lasted from seven months to five years. One patient showed a positive Wassermann reaction; then radium was resorted to but it also did not benefit him. He did not submit to tuberculin treatment.

Of the 21 scleritis and sclerosing keratitis cases, all showed positive focal reaction, and 13 were under observation from 2 to 10 years; 12 of these have recovered; one, although under continuous treatment for over 3 years, has not shown any material benefit from tuberculin. From the above 12 cured cases, 6 have shown relapses within one year or two after the termination of the treatment, which in the various cases lasted from 3 months to 2 years. In these cases a second tuberculin treatment was given, to which all of them responded rapidly, and up to this time no third relapse has been observed, barring one case.

Now 8 of these scleritis and sclerosing keratitis cases have not been seen again since the termination of their treatment, which lasted from two months to a year; 4 of these have recovered and 4 of them have been improved.

The iridocyclitis cases are 12 in number: 10 showed focal reaction to tuberculin; 2 only general and local; 10 were under observation from 3 to 11 years; 2 were not seen since the end of treatment. The tuberculin treatment in the various cases lasted from 9 months to 5 years. Only 2 of the 12 cases have recovered and they did not show relapses; one being under observation for 11 years, and the other for 10 years.

Now of the remaining 10 cases: 5 showed no benefit from tuberculin and 5 have improved. Both cases that showed no focal reaction did not benefit from tuberculin.

We had under treatment for a period of from 6 months to 4 years, 8 cases of iridochoroiditis: 4 of them showed focal reaction and 4 only general and local. The observation lasted from 3 to 5 years. The 4 cases which showed no focal reaction at the time of the diagnostic injection were not benefited by tuberculin treatment; of the other 4 three showed improvement and one recovered after 14 months' treatment, and showed no relapse at the time of his examination which took place almost 3 years after the termination of treatment.

The 5 cases of heterochromic cyclitis which are reported here all showed positive focal reaction; one was under treatment for only 3 months, showed improvement, and then disappeared. The remaining 4 were under observation from 3 to 6 years, and were treated with tuberculin from 14 months to 2 years. Now 3 of these have recovered; one showing a slight relapse 2½ years after the end of treatment, which lasted for 14 months. She again recovered after 6 months' treatment and is now well after 4 years. This patient's lens, which in these cases usually becomes cataractous, was removed and $\frac{20}{30}$ vision obtained. The fourth case is interesting, because 8 years previous to the time she came under our observation with heterochromic cyclitis, she came to our hospital suffering from recurring juvenile hemorrhages. She has been under tuberculin treatment for 2 years; her eye shows a great deal of improvement, but is not well as yet.

Of the 3 chorioretinitis cases, we observed focal reaction in 2, and no focal reaction in one. All three were under observation for 4 years; the treatment lasting from 8 months to 2 years; 2 recovered and one showed considerable improvement. No relapses were observed.

The choroiditis disseminata cases which are 4 in number were under observation from 3 to 6 years, and had tuberculin treatment for over 2 years. Focal reaction was observed in 3; 3 have recovered; while the one, where no focal reaction was observed, did not show any change after 2 years' treatment.

We have in this report 11 cases of exudative choroiditis under observation from 2 to 5 years. In 3 cases we observed focal reaction; in 8 no focal reaction was found. Of the 3 cases, where focal reaction was found, one recovered, but is still under treatment, lasting now for 4 years. No relapse has been observed. Another case has also been under treatment for 4 years; here tuberculin has not benefited the eye, as the apparently purely choroidal process spread, and developed into a chronic iridochoroiditis. The third case was under treatment for 8 months, when iridocyclitis, deep keratitis, and secondary glaucoma developed, necessitating enucleation.

Now of the 8 cases which showed no focal reaction 5 had dental infection. These cases were submitted to tuberculin treatment, but at the same time the infected tooth was extracted. All have recovered under this treatment; one showed a relapse which healed up after a second infected tooth was extracted, without any other treatment. In these cases in all probability the tuberculin treatment was superfluous; the origin of the choroideal infection being the teeth.

In the other 3 cases no focus could be detected; 2 of these, after 11 months' and 15 months' tuberculin treatment, have apparently recovered, but have not been seen since the termination of the treatment; the third one was not benefited by 9 months' tuberculin treatment.

All of the 11 periphlebitis retinæ cases showed a positive focal reaction. They were under treatment from 7 months to 3 years, with the exception of one, which, after two months' treatment, has disappeared. All of them recovered and showed no relapse during a period of observation ranging from 3 to 6 years, barring one, which, after 14 months' treatment recovered, and one year later returned with a relapse. He was submitted to another 6 months' treatment, and when last seen, 3 years after the termination of the second treatment, was well. One of the cases was complicated with a detachment of retina; in this case the periphlebitis was cured after 9 months' treatment, but the detachment remained unchanged.

Out of 5 detachment of retina cases, complicated with choroiditis, 4 showed focal reaction, and one only general. They were submitted to tuberculin treatment from 14 months to 2 years; but in no case did we observe any material change in the condition, although we observed these cases from 2 to 4 years.

I also report one case of tuberculosis of the optic nerve head which showed a typical focal reaction and recovered, with an optic atrophy after one year's treatment. He is still under observation and his treatment is still being continued.

As to the treatment in all the cases: tuberculin injections have been used besides the usual local treatment, such as hot applications, atropine, yellow oxide salve, etc.; and in a few cases where it was necessary, operative interference was also resorted to.

It may be mentioned here that in one case of scleritis and sclerosing keratitis, complicated with iridocyclitis and secondary glaucoma, where tuberculin treatment was used for 3 years with practically no benefit to the patient, marked improvement was obtained in September, 1918, by subconjunctival injections of guaiacol cacodylate, according to the recommendation of Darrier. The tuberculin treatment is being still continued; and at present, 5 months after the guaiacol injections, the eye is doing well—in fact better than it ever did before.

We have used these subconjunctival injections in a few other cases also, with the same gratifying results; but were compelled to discontinue them because it was not obtainable under the present conditions in New York City. It seems to me, however, from our limited experience, that the use of guaiacol, which by many is considered a specific in tuberculosis, is beneficial in tuberculous eye diseases, and it would be worth while to investigate further its healing qualities in these conditions.

Until 1914 we used exclusively for diagnostic, as well as therapeutic purposes, the imported Koch's tuberculin. When this was not obtainable any longer, Mulford's tuberculin was used, and gave us highly satisfactory results. All solutions should be fresh and not over two weeks old, as tuberculin in solution seems to lose its activity after this period. This is especially apparent when it is used for diagnostic purposes; as in some cases where no reaction was obtained when using an old solution, prompt reaction set in from the fresh one.

The method we use for treatment is the following:

The first injection is $\frac{1}{10.000}$ of a *mgm;* the dose is increased by $\frac{1}{10.000}$ of a *mgm* until $\frac{1}{1000}$ of a *mgm* is reached; then it is increased by $\frac{1}{1000}$ until a quantity by $\frac{1}{100}$ is given. Now we increase it by $\frac{1}{100}$ until $\frac{1}{10}$ is reached, and from now on by $\frac{1}{10}$ up to 1*mgm* which is the maximum dose. All general reactions are to be avoided; and if, after an injection, the patient complains of symptoms of a general reaction the same dose is repeated, or, if necessary, even a smaller dose given, until it is tolerated by him without reaction. The frequency of the injections is regulated partly by the amount given, and partly by the action of tuberculin upon the patient, which, of course, means that it varies with individuals. As a general rule, we give injections twice a week until $\frac{1}{1000}$ of a *mgm* is reached; once a week up to $\frac{1}{100}$; once in two weeks up to $\frac{1}{10}$; and once a month up to 1 *mgm.*

As to the length of treatment with tuberculin: no hard and fast rule can be laid down. It, again, depends upon the individual, the general condition of the patient, and the severity, duration, and form of eye disease he is afflicted with. In general it may be said, that it must be continued in all cases for a very long time. By this I do not mean months, but years; as we find that the best results have been obtained with those patients who do not become discouraged or do not discontinue treatment when the eye becomes apparently well, but keep up the treatment, getting an injection every 3 or 4 months, for years.

CONCLUSIONS

1. We consider an eye condition tubercular only when a positive focal reaction has been observed.

2. In cases where, for some reason or other, a positive focal reaction cannot be obtained, but the patient shows a positive general and local reaction, and every other possible cause for the eye condition is, with reasonable certainty, excluded, we consider the case of probable tuberculous origin.

3. For diagnostic and therapeutic purposes, tuberculin should always be used in fresh solution, not over two weeks old.

4. For diagnosis in eye conditions, only the subcutaneous injection is of value. It can be used in children as well as in adults with practically no danger.

5. Tuberculin is a valuable remedy in ophthalmic therapeutics provided it is used in very small doses, in positive tubercular eye affections, *i. e.*, in eye affections where a positive focal reaction was obtained. Used under these conditions there is no danger involved.

6. The treatment should be started with a very small dose — $\frac{1}{10.000}$ *mgm*, increasing it slowly to the maximum dose that

the patient can tolerate, which in no case should exceed 1*mgm.* During treatment all reactions should be avoided.

7. Duration of treatment should be long. Relapses being frequent in those cases where treatment has been discontinued after an apparent cure following treatment of less than 8 months.

8. Best results have been obtained in those cases where treatment was continued for several years, and in which, after the apparent cure, an injection of the maximum dose was given once every 3 or 4 months.

9. Tuberculin is of least value in chronic uveitis cases, with the exception of heterochromic cyclitis; while in the cases of scleritis and periphlebitis retinæ the tuberculin treatment is most satisfactory.

10. Scleritis, deep and interstitial keratitis, and iridocyclitis are closely related to each other and have not a separate entity, but may change from one condition to the other, a clinical observation which is borne out by the pathological findings of Treacher Collins.

11. Exudative choroiditis cases are seldom of tubercular origin, the source of infection often being the teeth.

SUBSTITUTE OPERATIONS FOR EXCISION OF THE EYEBALL.[1]

I. IMPLANTATION OF A METAL BALL IN TENON'S CAPSULE

By Dr. WILLIAM M. SWEET, Philadelphia.

SINCE I began in 1904 to employ the Frost Lang method of the implantation of a metal ball in Tenon's capsule, I have operated in 146 cases in which there was no contraindication to the operation, with the loss of the ball in four cases. In 1910 I reported forty-eight cases of implantation, with the loss of two balls from infection or cutting out of the central sutures. Of the ninety-eight cases operated on since 1910, one ball was lost from infection, in a case of complete sloughing ulcer of the cornea, and the other in a case of shrunken tender eyeball in a child. In no instance during the past six years has the implanted ball been extruded, and this result is no longer expected. Should, however, the ball come out, I believe that a more movable stump is secured than if the ball had not been implanted.

In the report above referred to I summarized the advantages and contraindications of the operation of implantation of a ball in Tenon's capsule, and since that time I have seen no reason to modify these conclusions:

First: The stump in practically every case gives a more movable artificial eye than ordinarily follows simple excision. In some cases of enucleation in which the muscles have been sutured to the conjunctiva and care exercised to preserve all conjunctival tissue, an excellent movable prothesis is secured, but this result is uncertain.

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[1] Series of papers presented at meeting of Section on Ophthalmology, New York Academy of Medicine, January 20, 1919.

Second: The depression of the tissues immediately beneath the brow and the tendency to enophthalmos of the artificial eye are less marked.

Third: The floor of the orbit after healing is flat, with occasionally a slightly raised portion in the center where the implanted ball projects forward, a condition superior to the deep, furrowed, and often irregular socket which serves for the retention of the secretion that so often follows simple enucleation.

With the exception of eyes with malignant growths and those purulently inflamed, there is no contraindication to the operation of implantation. I do not feel, however, that the insertion of a gold ball after the removal of an atrophic stump is a satisfactory procedure, because all the tissues are shrunken and even a small sphere must exert more pressure upon the orbital tissues than is the case after the removal of a full-sized eyeball. In the latter the capsule contracts and forms a firm envelope around the sphere, and the nerves are retracted beyond the reach of dangerous pressure. In the severe types of traumatic iridocyclitis requiring enucleation, even though the other eye has become irritated, there is, in my opinion, no greater danger of sympathetic ophthalmitis than if ordinary excision was performed without a gold-ball implantation. I believe that should sympathetic ophthalmitis appear, it would have occurred no matter what operative procedure had been followed.

Method of Operation.—The enucleation operation as at present performed is followed, with some slight modifications. In dissecting the conjunctiva from the limbus the usual precautions are taken to preserve all the conjunctival tissue, and to avoid any tearing or cutting into the membrane, which will later cause the formation of cicatricial bands. Each of four straight muscles is picked up on the hook and stitched to the conjunctiva in the normal position or brought forward to the edges of the cut conjunctiva, and is then severed from the globe. After the optic nerve has been cut, the oblique and the remaining tissues are severed, and hemorrhage is stopped by deep pressure in the bottom of the socket with dry sterile gauze. It is not necessary to wait until the oozing has entirely ceased. After the gold ball is in the capsule the pressure stops all bleeding. The center of the upper border of the cut Tenon's capsule is now grasped with forceps and a suture inserted from without inwards, about 1 or 2*mm* from the edge, and then passed similarly from within outwards through the lower capsule border at a corresponding point. Before the suture is tied, the gold ball, 14*mm* in diameter, which has been sterilized in a gauze sponge, is dropped into the exposed cavity, the suture tied, and one end of the thread cut off. The capsule is raised by the attached suture, a strabismus hook passed along the cut edges to the extreme nasal side of the capsular opening, at which point another suture is inserted bringing the edges of the capsule together. One end of this suture is cut off. Similarly a suture is placed at the extreme opening of the capsule on the temporal side. An assistant grasps the central and one of the peripheral sutures, raises the edges of the cut capsule from the bottom of the orbit, and the operator brings the edges together by interrupted sutures. The central and other peripheral suture raises the other portion of the capsule, which is also sewed together. About eight or ten sutures are needed to close the capsule over the ball. If the capsule in any portion is so thin that the ball shows through, some of the adjoining tissues are brought over by suture to cover in the thinned portion. The conjunctival edges are brought together in the horizontal direction with interrupted sutures. A binocular bandage is applied. At the change of dressing the following day, a monocular dressing is applied, and the patient allowed out of bed.

White silk is used for both the sutures in the capsule and the superficial sutures in the conjunctiva. The imbedded silk sutures have never caused any trouble, and are not removed. At the Wills Hospital, Philadelphia, several of the attending surgeons have employed fine chromisized catgut for the sutures in the capsule with good results.

Size of the Ball.—I have experimented with balls of different sizes, but in recent years have adhered to a ball of 14*mm* in adult cases. As a matter of fact, in some robust individuals with prominent eyes the artificial eye maker has found the protrusion in the center of the socket so great with the 14*mm* ball that it was impossible to use the reform shell. Since the implanted ball is not intended to be a substitute for the eyeball but acts as a bed upon which the prothesis rests and gives a support for the action of the four recti muscles, there is no gain in employing a ball of a size approximating that of the normal globe. In six of the earlier cases platinum balls were employed with the thought that possibly the gold might be acted upon by the body fluids. It was not possible at that time to secure platinum balls as light in weight as the gold, and scarcity of the metal in recent years has not encouraged further experiments on the part of the maker to turn out a lighter product. I have had no opportunity of examining a gold ball after it has been in the tissues for a long period, but an X-ray plate of a case in which the ball has been in the orbit for twelve years failed to show any erosion of the metal.

Complications.—The reaction after operation is usually no greater than after simple excision, and the patients leave the hospital within a week. Occasionally there is considerable swelling of the conjunctiva and the lids, but this is plainly due to the effusion of blood and serum into the orbital and lid tissues. If the globe is removed promptly after the optic nerve and ciliary vessels are cut, so that free egress of blood is permitted through the conjunctival opening, swelling of the lids is rare. The œdema is also more likely to occur if the speculum is removed before the hemorrhage has stopped. Marked swelling of the lids and conjunctiva protract the convalescence but does not cause loss of the sphere.

In two instances in the early days, when experiments were made with catgut for suturing the capsule, some of the central sutures cut out, allowing the ball to protrude between the edges of the conjunctiva. The wound edges were touched with the mitigated nitrate of silver stick, and repeated every second day. Granulations formed, and the balls were ultimately covered in.

Displacement of the Ball.—In none of the cases has the ball shown an appreciable change of position. The method of tying the ends of the four recti muscles over the ball after the capsule sutures have been inserted appears to favor displacement of the ball, probably from contraction of the tissues and the forcing of the ball obliquely out between the muscles. In several of the earlier cases, this plan of securing the muscles was tried, but I was unable to determine that it possessed any advantage over the method described above.

Sympathetic Disease.—At the time of the publication of the previous report of the results of operation I had seen only one case in which there was the possibility that the implanted ball had caused irritation of the remaining eye. This patient, a physician, was under treatment at the time the report was made, and a detailed history of the case was given. The man had perfect comfort for three years after the implantation, and had worn a reform eye during that period. The prothesis broke, and after a new one had been worn for a few weeks he found that he was unable to do any close work without pain, congestion of the eyeball, and some lacrimation. There was no tenderness upon pressure on the implanted ball nor did the prothesis cause any perceptible irritation of the socket. Several additional eyes were made without relief, and he then became so apprehensive of sympathetic disease that he asked that the implanted ball be removed. He was in good health, but under heavy strain in connection with the surgical work of a large general hospital connected with a steel works, and was advised to take a rest. He was away from his work for several months. After a few weeks all signs of irritation subsided, and he has been wearing an artificial eye with comfort for many years.

I believe the implantation of a metal sphere into Tenon's capsule to be free from all danger of sympathetic trouble, and I have failed to find the report of a case that could be traced to the operation. In my previous report I analyzed the several cases that were quoted as instances of sympathetic disease following the implantation operation. Two of these were embodied in the report of the Committee on Excision of the Ophthalmological Society of the United Kingdom. The committee in its analysis of the cases stated that in neither instance could the sympathetic disease be caused by the implanted ball. In de Schweinitz's report of seventy-two implantation operations by American operators only one case of sympathetic irritation was reported, and this was shown to be due to a badly fitting shell. In Sattler's case the cut end of the optic nerve was found to be firmly surrounded and imbedded in dense cicatricial tissue. Davis's case was one of paraffin implantation. Upon opening the socket it was found that the paraffin ball had escaped from Tenon's capsule, and lodged in a solid mass at the posterior part of the orbit. Upon removal of the paraffin the symptoms disappeared.

Every operator of experience is able to recall cases in which there was good movement of the prothesis and little if any sinking of the tissues beneath the brow after simple enucleation. These cases, I believe, are the exception. In the majority of instances there is a distinct staring appearance that cannot be corrected. With the implantation operation the results are generally satisfactory. A certain degree of movement is always secured, in some individuals greater than in others. In a small proportion of the cases, however, with the same care in technic, there is sinking of the tissues of the upper lid after the lapse of a few months, but probably not the same degree as in simple excision.

As I stated in a previous report, measurements of the degree of rotation of the artificial eye are of limited value, as they depend largely upon the shape and fit of the eye. Even when there is good movement of the conjunctival bed, an improperly fitting eye may give only moderate rotation. Two eyes, both well-fitting and comfortable, may show considerable difference in the degree of rotation. From the shape of the prothesis and the depth of the cul-de-sacs greater rotation is always secured in the vertical than in the horizontal meridian.

II. FAT TRANSPLANTATION INTO TENON'S CAPSULE AFTER ENUCLEATION.

By Dr. A. N. ALLING, New Haven, Conn.

As far as I am aware the first record of the transplantation of fat into Tenon's capsule after enucleation appeared in a South American Journal about 1901, but the operation was later reported from some of the Continental clinics by Bartel *et al*, and it has been practiced more or less by ophthalmologists since that time. When the procedure was brought to my notice I was inclined to try the transplantation of living tissue instead of employing foreign bodies of glass or metal which had formerly been used, and which were sometimes extruded or became infected and in 1909 I performed the following operation.

The conjunctiva was cut and dissected from about the cornea but before severing the recti muscles, each was caught with a catgut suture. The enucleation then proceeded in the usual manner and a purse-string suture of large size was passed well back around the cut edge of the conjunctiva. After bleeding had stopped a skin incision, about three inches long, was made in the abdominal wall and a mass of fat about the size of the eyeball was excised, quickly carried to the socket, and forced in. The muscles were then tied across the fat mass and the conjunctiva closed over it by the purse-string suture. The wound in the skin was sutured and put under a pressure bandage.

Since that time I have modified the operation in one particular. I no longer suture the muscles over the fat and I cannot see that the motility of the stump is decreased to an appreciable degree, and it certainly simplifies the technic.

The questions which naturally arise are first, whether transplanted tissue like fat, which is of relatively low vitality will become organized under these conditions; and, secondly, whether it will shrink. The answer is that the fat is almost invariably retained without degeneration and that it *does* shrink but never less than one half its original size. In spite of the latter fact a sufficiently large stump permanently remains so that the artificial eye is not sunken and has a considerable amount of motility.

One difficulty which I have encountered is that the conjunctival suture is very likely to give way in the first few days leaving a small area of fat exposed, especially if too much fat is used, but this has always been covered over in a short time. However I now place a few supporting sutures in the conjunctiva across the wound to relieve the tension.

Counterindications against the operation are enucleation for malignant tumor, as well as in eyes which have active infection, and I think also that cases in which there is extreme congestion may not do as well—at least the only case of mine which failed was one of this sort.

I commend this operation to you.

III. IMPLANTATION OF A GLASS BALL WITHIN TENON'S CAPSULE BY VERHOEFF'S METHOD.

By Captain HARVEY J. HOWARD, M.C., Medical Research Laboratory, Hazelhurst Field, Mineola, N. Y.

ABOUT a year or so ago Major Verhoeff abandoned the technic involving the tying or suturing of the four recti muscles in front of a glass ball following enucleation because of the general experience that many of the balls thus implanted either came out or became displaced into a quadrant space between two of the muscles. He accordingly worked out the following technic and the results obtained therefrom have been very gratifying.

The operation is begun in the usual way. As soon as the conjunctiva is freed from the limbus it is separated with the scissors from the underlying Tenon's capsule all around for several millimeters back from the margin. The process of enucleation is then continued but care is exercised not to buttonhole Tenon's capsule. The muscles are all cut at their insertions and allowed to retract as far as they will.

After bleeding has sufficiently stopped, a large glass ball, generally about 18*mm* in diameter, is inserted within Tenon's capsule. By this method a larger ball may be used than when the muscles are sutured in front of it. A double-armed heavy silk thread is used for suturing the capsule. The two needles are put in, three or four millimeters apart, from the inside of and several millimeters back from the margin of Tenon's cup, beginning let us say from the patient's left side. The two needles are then inserted in the same manner successively at three other places in Tenon's capsule, 90° apart, viz.: above, at the right side, and below. Each pair is so inserted that there is no crossing of the thread when the latter is drawn up. If the double suture has been put in properly there should result at this stage a fairly smooth overlapping of each sector of Tenon's capsule upon the one previously sutured so that finally there are four thicknesses of Tenon's capsule in front of the ball. The two ends of the suture are then brought through the conjunctiva somewhat below the middle line, inserted through a pearl button, and tied. The conjunctiva is then sutured in a horizontal median line with interrupted sutures of finer silk than previously used and of sufficient number to give good opposition. The pearl button prevents the conjunctiva from becoming œdematous and bulging out. It also makes it easier to remove the suture which is done in about a week.

Inasmuch as the glass ball prevents shrinkage of the conjunctiva and the onset of an irritating entropion which often occur following enucleations without implantation, there is no need for haste in requiring the patient to wear an artificial eye. It is Major Verhoeff's custom to permit one to be worn three weeks after operation.

As to results, the three important features of special interest to us are the retention of the glass ball, the motility of the artificial eye, and the proper projection of that eye in the orbit. I admit that it is unscientific to try to build up a strong argument based upon the results of a small number of cases. However, I think it worth while to sum up briefly what the results thus far have been.

There have been performed at the Massachusetts Charitable Eye and Ear Infirmary by six different surgeons during the past year about twenty-five of these implantations. Unfortunately the records of a number of them are incomplete in not differentiating between the muscle method and Tenon's capsule method. After eliminating these I find that there are thirteen cases whose records are complete. The unanimous testimony of the six surgeons is that in no case did the glass ball come out. Obviously it is impossible for a ball implanted by this method to become displaced, for the pressure of Tenon's capsule upon the glass ball is uniform over its surface. On the other hand when the muscles are sutured there are produced distinct lines of pressure tending to force the ball into one of the quadrants. For comparison it is of interest to give the experience of Lieutenant Dowling, a recent House Surgeon, who states that during his service at the Infirmary he followed twenty cases of implantation which he performed himself or in which he assisted. In ten of the twenty cases the glass ball was held in place by the sutured muscles. Of these three of the balls came out and one became displaced between the muscles and had to be removed. In the other ten the glass ball was implanted within Tenon's capsule by Verhoeff's method. In none of these, he states, did a ball come out or become displaced.

As regards motility of the artificial eye: It has always been conceded that the motility of the eye was more extensive in those cases where the ball was implanted behind the recti muscles than when no ball was used. Suffice it to state that the motility is fully as good when the muscles are allowed to slip back and the ball implanted within Tenon's capsule. In order, however, to put on record what the motility of an artificial eye is under the latter method of implantation I herewith give tropometer (Stevens) readings of one case both of the sound and the artificial eyes. For these readings I am indebted to Major Lancaster, who made them this past week at my request upon a boy seventeen years old whose right eye had been enucleated and upon whom an implantation had been done four months ago by Doctor Burke, the present House Surgeon at the Infirmary in Boston:

Right Eye (*artificial*)		*Left Eye*
R	20°	50°
L	12°	50°
Up	18°	40°
Down	22°	40°

An exophthalmometer reading done at the same time showed not over a millimeter of difference in the projection of the eyes from the orbit.

IV. FROM THE STANDPOINT OF THE ARTIFICIAL EYE MAKER.

By Mr. PIERRE GOUGELMANN, New York.

THE initial step toward properly adapting a prothesis in a comparatively recent enucleation is to separate the lids as far as possible, giving the adjuster every opportunity of making a careful observation of the socket—primarily with the object of locating adhesions which in some cases are the cause of considerable annoyance to the patient. Secondly, to photograph, as it were, on the mind, a picture of the socket. This is very important, as an improperly adapted eye will sorely discourage the patients who as a rule are in an extremely nervous condition. The shape of the prothesis varies according to the facial development of the individual, the nasal and temporal bones changing the formation of the socket, which correspondingly affect the shape of the globe inserted. There is also great variation in the shape where the loss has been occasioned by accident, explosion, or by disease, particularly glaucoma. Finally, the loss of eyes among soldiers from shrapnel naturally makes an ugly cavity in the lower lid.

When bone has been removed, a very unusual case results, and it requires some experimenting in blowing a globe which conforms to the socket and gives the eye the correct focal alignment.

In cases where there is a natural stump, a gold ball insertion, or a fat implantation, the shapes are generally alike, varying principally in size. These usually require an eye full on the lower side, quite shallow on the top, and with the iris almost centrally located on the horizontal line.

The patient is usually instructed to wear a temporary eye for a fortnight. At the second visit, conditions permitting, the permanent eye is made. Employing the shape originally inserted, we note what changes are required either in size or position, bearing in mind that an eye too large is more repulsive than one a trifle too small. Both from the standpoint of the maker and the patient, a smaller eye is more desirable. A large eye is painful and requires an effort to close the lids, and in time will either develop adhesions from pressure or produce an irritation of the lid, necessitating the substitution of a much smaller eye. In extreme cases this causes such a contraction that a plastic operation is required.

Ordinarily, an eye can be comfortably worn for the period of a year; in some cases for a shorter time, in others for a longer period. We have had cases where the individual has worn an eye for twenty years without ever removing it, the socket suffering very little from this harsh treatment. Acid conditions of the system as in rheumatism and anæmia shorten the life of an eye as they cause either a crystalline deposit that makes the eye as rough as a file on the outer surface and causes the unfortunate wearer uninterrupted agony, or as in other cases resulting in a discoloration of the sclera and a consequent lifeless and disagreeable color effect. This latter condition can be remedied to some extent by giving the prothesis a bath in peroxide for a few days. This has the effect of bleaching the eye.

Pronounced adhesions are the cause of great trouble in adapting an eye. There is present in the socket, a fold or cord at the outer canthus, which can be readily seen by having the patient rotate his eye inwardly or lifting the fold of skin at the outer canthus. When this is not too pronounced the prothesis can be so shaped that it will fit around this cord, preventing pressure and relieving the patient of periodical annoyance. These bands may be so pronounced and numerous that it is impossible for the eye maker to obtain satisfactory results, and may be the cause of great disappointment to the patient.

In emaciated cases the cosmetic results are far from satisfactory. This is due presumably to lack of fat tissue in the socket. The result is that an ugly depression will be evident in the upper lid. This is very distressing in cases of young girls. No eye can be made that will fill this vacancy though an eye blown at this particular point will overcome, to a minor degree, this shortcoming. This will, however, affect the correct alignment of the eye. If an eye is made large at one point to obviate this condition, it will have to be made correspondingly larger at the other end to retain the correct relation to the other eye.

We have identically the same condition in glaucoma. While there is plenty of space, apparently the lids are short (a full eye will be "pop-eyed" in appearance), a very flat eye is the only relief but this does not overcome the depression. In these cases we would welcome any suggestion on the part of the oculist. To all concerned the result has been a disappointment. There may be a way of overcoming this poor cosmetic result by some form of implantation operation.

During the past ten years we have had many cases of foreigners principally from Russia who, due to an accident or from disease in childhood, have lost an eye. For some unaccountable reason, no attempt has ever been made to replace the lost member. The socket as well as that side of the face has perceptibly shrunk. In such cases we start by inserting (sometimes forcibly tying in) an eye about 14*mm* in length to make space, increasing the size at regular periods. By this means of dilatation we have had most successful results.

Where the socket has been mutilated through the use of too large a shell, or where it has been wrongly ground down to fit the cavity leaving a sharp cutting edge instead of being smoothly reduced in size in a flame, here it is sometimes possible to successfully treat the case through dilatation, though in the majority the plastic operation is the only relief.

We marvel at the progress made in these plastic cases. Lime and strong acids so reduce the socket that it is a mere slit like an incision resisting any effort to insert an eye. Formerly it was an assured conclusion that nothing could be done to enlarge the socket. This condition has been entirely changed by the reconstruction of a socket through modern methods, making it possible to insert an eye, thus restoring to the patient an almost natural facial condition. These cases are difficult to fit, the socket being flat at the lower edge and deep on the upper, or vice versa, necessitating a very irregular and peculiar shape. In some of these cases at the outer canthus there is no space whatsoever, the cul-de-sac being so shallow that it blends with the skin at the temporal side. Nevertheless the results have been most encouraging.

The mobility of the eye can be fairly well determined before the insertion of the prothesis. Have your patient rotate his eye and you can very accurately predict the amount of motion by the muscular movement. The best motion is obtained in a natural fully developed stump, as the shell when successfully adapted can deceive even the most observant oculist. It has, in several cases, successfully defied the "all-seeing" wife for a quarter of a century. Some stumps are too sensitive to permit a capping, but these are negligible in number.

The reform eye is a distinct advantage over the shell, in so much as it does not require as much body, lessening the pressure on the walls of the socket and eliminating entirely the possibility of developing adhesions. Besides, the edges being more rounded off are less irritating. The back of the eye sets more perfectly on the muscles and adds to the mobility. The relief and comfort to the patient are pronounced.

Thus, in a period covering the last twenty-five years, our experience in fitting eyes has shown us that a marked progress has been made in the method of operating in so far as the cosmetic effect on the patient is concerned.

The trouble in the past years has been that the cavity in the upper part of the eye has been so pronounced that it was utterly impossible for the eye maker to give satisfaction to the patient because no prothesis could be made that would extend in that section of the orbit. This gave the eye a sunken appearance as compared to the natural eye.

Where the ball of the eye is almost intact, in other words, a natural stump, no difficulty exists because the mobility of the eye is not interfered with and no apparent depression is visible. Of course the number of these cases is insignificant, but the result is most gratifying to all concerned.

A peculiarity of our experience in cases of enucleation has been that many of the cases show a decided depression, while in others this is absent, and the motion seemingly good. In the latter case good results can be obtained.

A very gratifying result in recent years has been the introduction of the gold or glass ball in the socket. This seemed to have overcome the difficulty mentioned before, and gave the eye a very natural appearance. Unfortunately this ball sometimes works out, leaving the patient in the unfortunate condition which he would have been in, under an ordinary enucleation. These cases on the whole have not been very numerous. The disadvantage lies in the fact that the ball is so far forward that it is difficult to make a prothesis thin enough to prevent abrasion and consequently wearing out the tissues over the ball. Of course this happens in only a limited number of cases, and in the others this condition is not present.

The fat implantation in the socket seems to contain the perfect solution of the problem as viewed from our standpoint —cosmetic effect.

In these cases it is not necessary to explain to the patient why satisfactory results are impossible, because by this method the eye is restored to its natural contour.

It has been suggested frequently by members of the medical fraternity that a mold of the socket be made and that the artificial eye be made an exact replica of this. This is impracticable because the eye being made by hand and not in a mold, cannot be identically reproduced. So far the cases in which the fat transplantations have been used have always been entirely satisfactory and have left nothing to be desired. The one drawback which possibly cannot be overcome is that the outward and upward motions do not seem to be quite as evident as the inward motion, though we have experimented in many ways by making shapes which were not quite as full on the outer canthus. It appears this has not the desired result in increasing the motion.

One argument against this form of operation, the fat implantation, has been that in time the fat will be absorbed. This, however, is the exception and not the rule, as noted in all cases treated. In the first case of this kind, treated some ten years ago, there has been practically no absorption.

We would gladly welcome any suggestion on the part of the oculists, and feel confident that all concerned would be benefited by consultations and conferences on this matter. In fact, it would be well if oculists were more familiar with the difficulty met by the eye manufacturers in producing satisfactory work, in order that some measure might be discovered whereby these difficulties would be overcome.

KERATITIS PROFUNDA IN BOTH EYES FOLLOWING INOCULATION WITH ANTI-TYPHOID VACCINE. REPORT OF A CASE WITH REMARKS.[1]

By Dr. GEORGE HUSTON BELL, New York.

AMONG the recently recorded sequelæ of anti-typhoid vaccination will be found a few examples of ocular lesions. Although the number of reported cases is very limited, attention may well be drawn to them.

It is important that all pathological phenomena arising in patients immediately or shortly after inoculation should be thoroughly investigated and that every endeavor should be made to determine if the relation between the vaccination and the subsequent lesions is causal or merely incidental.

In this case of mine I have, I think, been able to eliminate syphilis, tuberculosis, the teeth, and the tonsils. The patient had two Wassermanns and a spinal puncture, all of which were negative. He also had three injections of the old tuberculin which were given in increasing doses, without any reaction. The X-ray of his teeth was negative and his tonsils had been enucleated.

This man, married, age 24, came to my clinic at the New York Eye and Ear Infirmary on September 19, 1918, with the following history. When he entered the army he had vision of $\frac{20}{20}$ O. U. Last November he was inoculated twice with anti-typhoid vaccine. The first injection was followed by no untoward complications. One week later he received his second vaccination. The next day he had a chill, headache, malaise, and a rise of temperature. His eyes began to bother him. He suffered greatly from the light and could not keep his eyes open. He experienced great pain in both eyes and his eyelids were swollen. He was treated in the hospital at that time for his eyes for two months. Both eyes became inflamed at about the same time.

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[1] This patient was shown to the Section on Ophthalmology at the New York Academy of Medicine, on March 17, 1919.

Status præsens.—His vision when I first saw him was $\frac{5}{200}$ O. U. He has a deep keratitis O. U. His pupils react to light and the eyes are perfectly quiet. There are some gray opacities in the deep layers of the cornea; seen with the naked eye, the opacities seem uniformly gray, while with the magnifying glass these opacities may be resolved into dots or maculæ; some of these dots seem to be pigmented. The pigment might have come from the uveal tract or from degenerated red corpuscles. In keratitis profunda the participation of the iris is mostly limited to hyperæmia, that is the reason why his pupils react so well to light. This patient has been discharged from the army and now receives a pension from the government every month.

It is interesting to note that all the cases of keratitis that I have seen reported, occurred after the second or third injection of the vaccines, showing an anaphylactic phenomenon caused by the previous action of some toxins or bacteria.

De Lapersonne (1) in a recent report says: "It is common knowledge that owing to imperfect sepsis, severe septic infections may follow the administration of anti-typhoid vaccine." He cites a case of a soldier who, after a second or third injection, suffered from multiple boils, septic pneumonia, metastatic purulent uveitis leading to the loss of one eye. Such complications cannot be attributed to the vaccine per se, and moreover are wholly preventable.

Morax (2) has observed a case of a soldier, age forty-three, who developed herpes of the cornea, following the second injection of the vaccine. Morax also reports another case of paramacular retinal hemorrhage after the second vaccination.

Gloagen (3) of Cherbourg reports three cases of keratitis after anti-typhoid inoculation with vision greatly reduced.

As late as January, 1919, Bussy (4) of Lyon, France, who had charge of the ophthalmic service in a section where 22,000 troops were vaccinated against typhoid, reported that five of the men developed ocular lesions. Bussy advises testing the blood pressure as well as examining the urine before inoculations. One of Bussy's cases had albuminuric retinitis and died two months later of uræmia. Another one presented severe hemorrhages in both retinæ after vaccination. The three other cases developed herpes and ulceration of the cornea.

I report this interesting case of mine because I consider that all lesions which may occur after anti-typhoid inoculation and which can be regarded as due to it should be recorded. No lesion should be ascribed to the inoculation which does not arise during, or very shortly after, the series of injections, and after a thorough investigation.

This deep keratitis seems to me to be a case of typical anaphylaxis, bacterial in origin. The first injection of the vaccine sensitized the cornea, and the second injection acted as an anaphylactic dose.

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THE EXPERIMENTAL PRODUCTION OF PANOPHTHALMIA BY INFECTION FROM THE BLOOD STREAM.

By PAUL WEGEFORTH, Captain, Medical Corps, U. S. Army.

From the Army Neuro-Surgical Laboratory, Johns Hopkins Medical School, Baltimore, Maryland.

(*With six illustrations on Text-Plate VIII.*)

THE report given here on the experimental production in cats of a panophthalmia after inoculation of the blood stream with a suitable organism may be considered as a corollary to the recent communication from this laboratory—Weed, Wegeforth, Ayer, and Felton (3)—concerning the experimental localization in the meninges of certain blood-stream infections. It was there shown that the withdrawal of cerebrospinal fluid during a suitable experimental septicæmia resulted inevitably in the production of a typical meningitis. The close anatomical and physiological analogies which exist between the structures concerned in the elaboration and drainage of the fluids of the eye and brain have been frequently noted—Henderson (2), Wegeforth and Weed (4). Likewise the great similarity of many of the pathological lesions of the two systems is well known, and a close relationship in the selective action of certain bacteria for these tissues is indicated by the frequency with which panophthalmia is associated with epidemic cerebrospinal meningitis. A consideration of all these circumstances suggested that experimental methods similar to those employed in localizing blood-stream infections in the meninges might be used for producing infections of the eye. Two of these procedures, the release of fluid from the anterior

FIGURE LEGENDS

FIG. 1. Photomicrograph. Filtration angle, of left eye (control) from a cat given intravenously a sublethal dose (0.25*cc* twenty-four hour broth culture) B. aerogenes lactis. The aqueous was not removed after the inoculation. The structures are normal. Hæm.-Eosin X 12.

FIG. 2. Photomicrograph. Filtration angle, of right eye from same cat noted in Fig. 1. The aqueous was removed after the production of the septicæmia. There is exudate in anterior chamber, associated with swelling and infiltration of the iris and sclera. Hæm.-Eosin X 12.

FIG. 3. Photomicrograph. Optic nerves and vessels of eye shown in Fig. 2. There is complete absence of posterior extension along these pathways of the intraocular inflammation. Hæm.-Eosin X 12.

FIGS. 4 and 5. Photomicrographs of two eyes infected with B. aerogenes lactis by withdrawal of aqueous during a septicæmia. The involvement of the anterior portions of the eye in both cats was approximately the same. The retina in one (Fig. 4) was only slightly affected, whereas in the other (Fig. 5) the organ is covered with a thick exudate, the superficial layers are completely destroyed, the deeper zones are disintegrating, and the retinal vessels are surrounded by hemorrhage. Hæm.-Eosin X 70.

FIG. 6. Gross appearance of eyes shown in Figs. 1 and 2. On the left is the infected organ and on the right the normal control. Both taken from the same cat.

TO ILLUSTRATE DR. WEGEFORTH'S ARTICLE ON "THE EXPERIMENTAL PRODUCTION OF PANOPHTHALMIA BY INFECTION FROM THE BLOOD STREAM."

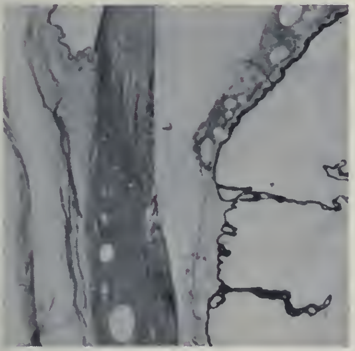

FIG. 1.

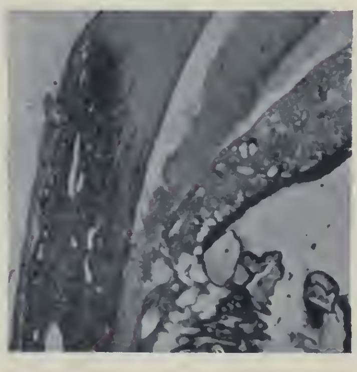

FIG. 2.

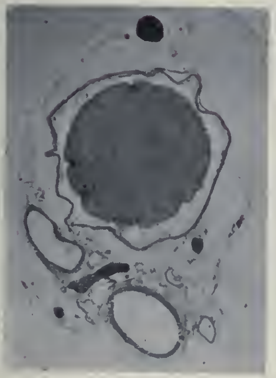

FIG. 3.

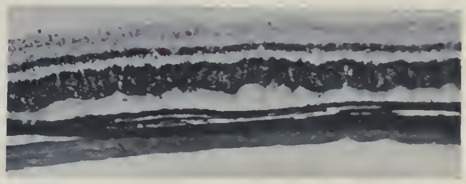

FIG. 4.

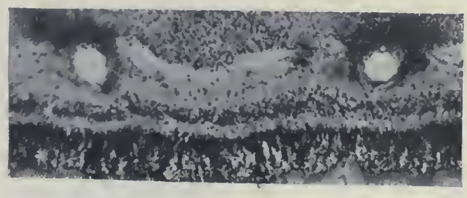

FIG. 5.

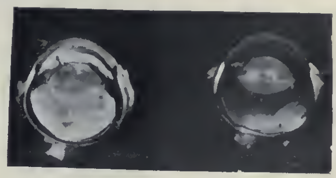

FIG. 6.

chamber of the eye and the congestion of the cerebral circulation during an experimental septicæmia, have resulted in the production of a purulent panophthalmia.

The microörganism used in these experiments was the B. lactis aerogenes. This bacterium had been used in this laboratory for much of the meningitis work—Felton and Wegeforth (1)—and direct inoculation with it into the anterior chamber of the eye proved that it possessed a marked virulence for this organ also. The most satisfactory method for inducing localization in the meninges of a blood-stream infection was the withdrawal of cerebrospinal fluid either by lumbar or cistern puncture—Wegeforth, Ayer, and Essick (5). An analogous procedure to this, release of aqueous from the anterior chamber, by puncture of the cornea, was adopted for the experiments on the eye. One of the methods then, for producing an ophthalmia secondary to a blood-stream infection consisted in giving the animal a septicæmia with B. lactis aerogenes by intravenous inoculation of sublethal doses of the organism. A few minutes after this inoculation, while the septicæmia was at its height, the aqueous was withdrawn from the anterior chamber of one eye, the other being left intact for control purposes. In performing the puncture of the cornea, the needle, in order to prevent the possibility of direct blood contamination of the anterior chamber, was directed obliquely to the iris, and extreme care was exercised that the point did not come in contact with this membrane.

Two of the four animals used for these experiments developed a severe generalized infection in the eye from which the aqueous had been withdrawn during the septicæmia. In one of these, notwithstanding the precaution taken to prevent injury to vessels by the point of the needle while it was in the anterior chamber, analysis of the aqueous removed showed the presence of a slight blood contamination (200 red cells per cu. mm.). In the other no trace of blood could be seen either in the anterior chamber after the puncture, or in the fluid withdrawn. The protocols of both of these cases are here given.

Cat No. 459. Adult Female.

March 29, 1918: 11.31 A.M.—Ether. Intravenous injection 0.25*cc* of a twenty-four hour broth culture of B.

aerogenes lactis. Two minutes later, 0.5*cc* aqueous removed from anterior chamber of the right eye by puncture of the cornea. Fluid obtained contains no red blood cells. 5 P.M. Anterior chamber filled with fluid; media of both eyes clear.

March 30th.—Media of both eyes clear. Ocular tension the same on both sides. Slight pericorneal redness of right eye.

March 31st.—Media of right eye cloudy and conjunctival redness increased. This eye is very tender. Left eye normal. General condition of animal is good although it is somewhat slow in its movements.

April 1st.—General condition still good. Right eye shows evidence of marked infection, some exudate in the conjunctival sac.

April 2d.—Cloudiness of media of right eye very marked, but the pupil can still be seen. Eye is still very tender, almost closed.

April 4th.—Condition of right eye has gradually become worse. To-day the eyeball is soft and mushy.

The general condition of the cat is still good, but on account of the condition of the eye it was sacrificed.

Gross autopsy.—The right eye is soft and appears to be somewhat larger than the left. There is considerable exudate in the conjunctival sac on the right, where the vessels are very much congested. At the site of puncture there is a small depression in the cornea, suggesting an ulcer; but there is no perforation. The cornea is thick, œdematous, and cloudy. The anterior chamber is filled with a thick, purulent exudate which continues through the pupil into the posterior chamber. Passing backward around the lens and vitreous, this exudate covers the retina in a thin sheet as far back as the fundus. The iris and the ciliary body are thick and injected. The central nervous system and the left eye appear normal.

Microscopic: Right Eye.—Sections were made after removal of the lens, through the antero-posterior axis of the bulb and stained with hæmatoxylin-eosin and toluidin blue. Most of the exudate seen in the gross has been lost during fixation and embedding but there is still a large amount hanging to the entire inner surface of the fluid spaces. *Cornea.*—The fibers are thick but the nuclei are stained well. At the periphery, the vessels of the limbus are congested and there is a marked polymorphonuclear cell infiltration of the tissue. The endothelium lining the posterior surface of the cornea is absent in places; in others it is apparently normal, while in still others the cells are swollen and undergoing degeneration. Descemet's membrane is everywhere intact. The iris and ciliary body are both markedly infiltrated throughout with polymorphonuclear leucocytes. The outer layers of the retina are swollen and disintegrating but their relations are still maintained. The inner layers are completely destroyed, the nervous tissue in this zone being practically confluent with the exudate covering it. The retinal vessels are greatly dilated and in many instances are surrounded by zones of hemorrhages (Fig. 5). At the filtration angle (Fig. 2) the exudate has been held by the trabeculæ in the spaces of Fontana and forms a solid mass. The inflammatory reaction in the sclera is limited to a relatively small amount of cell infiltration in the neighborhood of the vessels between the limbus and the level of the filtration angle. Posterior to this the sclera appears normal. The uvea, posterior to the ciliary body, is apparently normal. Examination of the sections stained with toluidin blue reveal, in the exudate, the presence of numerous bacilli morphologically like B. aerogenes lactis.

Left Eye.—Nothing abnormal was found (Fig. 1). Sections of both optic nerves (Fig. 3) and the optic chiasma were examined, but no evidence of an extension of the infection along these pathways was seen. The central nervous system showed no signs of involvement.

Cat No. 472. Adult Male.

April 2, 1918: 11.40 A.M.—Ether. Intravenous injection of 0.25 cc. of twenty-four hour broth culture, B. aerogenes lactis. Two minutes later 0.75 cc. aqueous removed from anterior chamber of the right eye. The fluid contained two hundred red cells per cu. mm. 5.00 P.M. Anterior chamber of right eye has filled. Media clear.

April 3d.—Media of right eye cloudy, pupil contracted, conjunctiva red. Eye very tender to touch. Left eye normal.

April 4th.—Media cloudy in right; eyeball tender and soft. General condition of animal is good.

April 5th.—Media of right eye very cloudy. Animal is weak and general condition is very poor.

April 8th.—Media in right eye has become increasingly more opaque. The eye is almost closed and the eyeball is extremely tender. The general condition of the animal is very bad, on account of which the cat was sacrificed with ether.

Gross Autopsy.—The right eye is quite soft and appears to be somewhat larger than the left. The iris is entirely obscured by the exudate in the anterior chamber. On section the exudate covers the entire inner surface of the eyeball.

The left eye is normal and the central nervous system shows no gross lesion.

Microscopical.—The same widespread involvement is present in the anterior chamber, iris, and ciliary body. The retina is covered with exudate but all of the layers are in places practically intact (Fig. 4). In others the superficial layer of larger ganglion cells has been invaded and destroyed by the infection. The infection has apparently spread backward from the anterior half of the eye. The tissues of the cornea and sclera are only invaded at the limbus and along the vessels at the level of the filtration angle. Numerous bacilli, morphologically like B. aerogenes lactis can be seen in the slides stained with toluidin blue. The left eye is normal throughout and examination of the optic nerves and optic chiasma do not show an extension of the infection from the right eye posteriorly. The central nervous system is normal.

In the first case there was no recognizable vascular injury during the withdrawal of the fluid from the anterior chamber. The cause of the localization of the infection, therefore, may be attributed to changes in tissue permeability resulting from a lowering of the normal tension of the eye. The infection had progressed too far, in this instance, to permit observations regarding the source of the infection, for all of the structures around the cavity of the bulb were already invaded. The second experiment was unfortunately complicated by a blood contamination at the time of puncture. Otherwise the picture was much the same as that seen in the first case, with the exception that the posterior half of the eye was apparently becoming involved by extension from the anterior half. This would indicate that the origin of the infection was from vessels in either the iris or the ciliary body, although the possibility of a passage of organisms from the scleral sinuses into the filtration angle cannot be excluded.

A third case of panophthalmia (bilateral) occurred during some experimental attempts to produce a meningitis by congesting the cerebral veins during a septicemia. In these experiments, after intravenous inoculation with B. aerogenes lactis, the jugular veins on each side were compressed from one to two minutes. The congestion in the head, resulting from this manipulative procedure caused in 50% of the experiments a localization of the infection in the meninges. One of the animals, in which this procedure failed to produce a meningitis, developed in the course of a few days an intense infection in both eyeballs. The protocol of the experiment is as follows:

Cat No. 986. Adult Female.

July 24, 1918: 11.32 A.M.—Ether. Intravenous injection 0.5*cc* of a twenty-four-hour broth culture B. aerogenes lactis. Two minutes later both jugulars and the adjacent structures of the neck were compressed with the fingers for one minute.

July 25th.—Animal is a little weak. Retraction of head causes no reaction.

July 26th.—Cat slow and cautious. No evidence of meningitis.

July 27th.—Cat is very cautious in movement, evidently blind. Examination shows in both eyes clouding of media, conjunctival injection, and contraction of the pupils. Both eyes are tender. Bilateral panophthalmia. 11.00 A.M. Ether. Anterior chamber of right eye punctured and 0.75*cc*. of a very thick, greenish-yellow pus obtained, which clotted in about one minute. The fluid contained 24 grams globulin to the liter; the gold sol reaction was 1322235433; the culture was positive for B. aerogenes lactis. A smear of the exudate showed a vast number of white blood cells, mostly polymorphonuclears with a few red blood cells and also numerous bacilli.

July 28th.—Cat is weak and very sick. Marked hemorrhage in the right eye. The right eye is collapsed and the exudate is draining through the opening made in the cornea yesterday. The left eye is soft and its media cloudy. No signs of meningitis.

July 30th.—Corneal defect of right eye has closed and hemorrhage has disappeared. Both eyes soft. General condition poor.

The animal's condition continued to grow worse and on account of this it was sacrificed on August 5th, twelve days after the inoculation.

Gross Autopsy.—Both eyes were reduced to soft mushy balls which on section collapsed. The interior was made up entirely of a thick purulent exudate in which only remnants of normal structures could be made out. The brain and spinal cord appeared normal.

Microscopic.—During fixation and embedding, both eyes folded up like a piece of cloth. The tissues were everywhere destroyed and hardly recognizable. There was no lesion seen in the central nervous system.

The experiments given here, while too few to afford a basis for any definite conclusions, are of interest for several reasons. The microörganism, B. aerogenes lactis, which proved so extremely virulent in the central nervous system, exhibited a similar pathogenicity for the eye. It is striking, however, that in the course of several hundred experiments on meningitis in which this bacterium was inoculated into the blood stream of cats, an ophthalmia was produced only once. In most of the experiments (withdrawal of spinal fluid by lumbar or cistern puncture) where the effects of the experimental procedures were limited to the central nervous system, only a meningitis resulted. In some of the others (compression of the jugulars) similar vascular changes were produced in the eye and the brain, so that a localization of the infection in either brain or eye was effected. When, however, procedures analogous to the withdrawal of spinal fluid were carried out on the eye the infection resulting was limited to the one organ which was operated upon, the opposite eye and the central nervous system being unaffected. Arguing by analogy, the changes produced by the procedure necessary to cause a localization of the infection in both organs are the same. In the brain these are felt to be dependent upon vascular changes brought about when the pressure of the cerebro-spinal fluid is either relatively or absolutely lowered. The experiments on the eye indicate that such a relationship holds in that organ. The close relationship between the withdrawal of aqueous humor during the experimental septicemia and the subsequent development of ophthalmia is indicated.

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REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By Dr. JOHN M. WHEELER, Secretary.

MONDAY EVENING, DECEMBER 16, 1918. DR. MARTIN COHEN, CHAIRMAN.

Dr. H. H. Tyson presented a case of **traumatic aniridia which followed the extraction with a Haab magnet of a foreign body which was in the lens.** N. L., male, age 29 years, applied for treatment at the Knapp Memorial Eye Clinic on September 24, 1918, with a statement that while hammering a piece of wood two and one half hours previously something struck his right eye and he thought a piece of wood was in it. Examination revealed a shallow anterior chamber with hyphæma, and a wound at the sclerocorneal junction nasally just below the horizontal meridian about 5*mm* long; the iris was cut and a dark object could be seen penetrating into the inferior nasal quadrant of the lens. T−2. Vision R. $\frac{20}{200}$; L. $\frac{20}{20}$. Suspecting the foreign body to be a piece of the hammer an attempt was made to remove it through the original wound of entrance with a Haab magnet, with the usual warning to the patient not to move his head, and to state when he felt any pain or unpleasant feeling in his eye. After several unsuccessful attempts, a final effort was made, during which he gave a groan and suddenly jerked his head backward leaving the foreign body which proved to be a piece of hammer 5*mm* in length with the entire iris hanging upon the tip of the magnet. Recovery was uneventful with vision $\frac{20}{30}$ with correction. Tension and the opacity in the periphery of the lens apparently stationary.

Dr. Chambers said that recently he saw a case of aniridia from injury one year ago, and the eyeball was in good condition.

Dr. Crigler thinks it remarkable that Dr. Tyson's case has so little dazzling.

Dr. Dixon said that whenever the X-ray shows a large, jagged foreign body he advises removal through a post-scleral opening to prevent injury to the iris. He thinks all foreign bodies should be skiagraphed to show the size and shape.

Dr. Walter E. Lambert presented a case with a **foreign body in the globe.** The patient, a man about thirty years of age, was struck in the left eye May, 1918. Was first seen by me on October 31, 1918. The left eye appeared perfectly normal, externally; pupil reacted promptly to light; vision with plus 5 combined with plus 2, axis 120, equaled $\frac{20}{200}$. Vision of right eye was $\frac{20}{20}$ with plus 2 combined with plus 2 axis 60. Ophthalmoscopic examination disclosed the presence of a piece of steel in the lower outer quadrant, projecting from the sclera. There were some vitreous opacities and some changes in the choroid. The optic disk was slightly congested. The condition to the present time is practically the same as when first seen; although there may be some slight increase in the optic neuritis. No attempt has been made as yet to remove the foreign body.

Dr. Emerson said that about three or four years ago he saw a case with foreign body near the nerve head. He made a scleral incision about ¼ the way back. He then inserted a punctum dilator and applied magnetic current. On withdrawing the punctum dilator the foreign body adhered.

Dr. Schoenberg suggested enucleation because of the condition of the eye which showed neuritis. He also suggested that a blood count might be significant.

Dr. Knapp thinks that the eyeball should be removed on account of pigmentation, optic neuritis, siderosis, and he would fear sympathetic ophthalmia.

Dr. Arnold Knapp presented a case of **bilateral subluxation of the lenses with fundus changes.** The patient, C. D., aged 28, has always had poor sight, especially for the last three years. The right eye sees m. h., field contracted to p. f.; the left, $\frac{20}{200}$. On examination, the right eye presents a tremulous iris, the lens is not in place. After dilating the pupil, it is possible to see that it is situated in the bottom of the vitreous chamber and presents the following peculiarities. There is a well-marked central opacity surrounded by a perfectly clear transparent ring through which the red fundus appears magnified. The eye ground shows an advanced stage of chorioretinitis pigmentosa. In the left eye the lens is dislocated to the temporal side, so that the nasal half of the pupil is free. The eye ground shows absolutely no evidences of inflammation, nor pigmentation, but a staphyloma verum.

The case is presented on account of the two following conditions. First, the curious appearance of the dislocated lens with its clear periphery which, to me, indicates an advanced stage of hypermature cataract, namely, a Morgagnian, in which the periphery has again become clear. Second, the pigmentation in the eye ground of this eye. The case suggests a condition which follows cataract couching.

Colonel Henry Smith in an article on cataract couching (*Transactions*, British Ophthalmological Society, 1904, p. 264), states that in the successful cases of couching at first the eye looks beautiful, but there follows a slow and steadily progressive degeneration of the vitreous and of the retina such as occurs in retinitis pigmentosa sine pigmento. This leaves vision in the least rapid cases very poor at four years after the operation and after a few further years no vision at all. This, in Colonel Smith's experience, is the invariable sequence.

Colonel Elliott, to whom we owe a book on the operation for couching for cataract, which was reviewed in the ARCHIVES, March, 1918, finds that chorioretinitis and retinal pigmentation are present in only between 1 and 2% of the cases. He cannot find any evidences to support the view that the lens in the vitreous brings about retinal changes, though he has found an undue distinctness of the choroidal vessels.

In this case there is a dislocated lens and the fundus shows chorioretinitis pigmentosa while the other eye presents no pigmentary changes. Whether in this case the dislocated lens in the vitreous was the cause for this pigmentary chorioretinitis, or whether the retinitis is just a further stage of the retinal condition which caused the dislocation of the lens, it is difficult to decide.

Dr. WEEKS said that the appearance of the lens was probably explained by the shrinking of the lens substance in the capsule. He said that unilateral retinitis pigmentosa is rare but not unheard of. He has not observed retinitis pigmentosa in eyes carrying dislocated lenses.

Dr. Cohen presented for Dr. H. W. Wootton, a case which had an **unusual appearance of a secondary cataract following extraction of a dislocated lens (traumatic).** Mr. W. G., aged forty-three, gave the following history. In 1900 he was struck over the left eye with a stone causing a subluxation of the lens. The eye remained quiet for several years when there developed a cataract which became mature in 1907. It was then successfully removed, resulting in excellent vision. After two years he again received a severe injury to the same eye by being struck with a window shade, resulting in a severe inflammatory reaction and producing hyphæma and blood in the vitreous, associated with severe pain lasting five weeks. At this time there gradually appeared a whitish membrane in the pupil. The treatment consisted of atropine, hot applications, and rest.

The patient was first seen by Dr. Wootton two weeks ago when he presented the following condition: Right eye normal. Left eye: vision, light perception. Field faulty in every direction. Tension normal. Eye free from any acute inflammatory manifestation. Cornea has a gelatinous appearance, most marked in the lower quadrant. This area shows deep striated opacities permeated with pigment and calcareous plaques. Pupillary space is completely covered by a milky white cyclitic membrane having a sharply defined circular perforation near its nasal border. Iris is atrophied and widely dilated without mydriasis. Pigment proliferation is seen on its surface, also areas of degeneration. Artificial coloboma is seen upward and filled in with the cyclitic exudate.

Major E. S. Sherman reported an **extraordinary case of foreign body in the orbit.** J. S., male, age thirty-three, a worker in a steel mill, while testing a pair of heavy knives used for cutting steel, felt something strike his right eye. There was not much pain and he supposed he had been struck by a small chip of steel. A few drops of blood came from the right nostril. He was brought to my office within an hour. There was a small V-shaped wound just above and to the nasal side of the center of the cornea, a laceration of the edge of the iris, and a rent in the anterior capsule of the lens with almost complete lenticular opacity.

When taken to the Newark Eye and Ear Infirmary an hour or two later and placed before the giant magnet there was no response and no pain. The eye could be moved freely and painlessly in all directions except towards the nose; power to rotate the eye inward was almost completely abolished. This condition persisted. As soon as practicable an X-ray examination was made which disclosed a long, slender foreign body extending from a point on, or just outside of the eyeball, and a few millimeters to the nasal side of the posterior pole backwards and to the left, penetrating the posterior ethmoid cells of the right side, crossing the extreme upper part of the nasal cavities, and passing through the left sphenoid sinus to the anterior wall of the pituitary fossa.

As there was considerable iridocyclitis and vision reduced to light perception, the eye was enucleated. The anterior end of the foreign body, about 3 or 4*mm* of which were in the orbit, was easily located in the orbital fat. With a pair of forceps it was easily removed in toto. It was found to be a piece of steel 57*mm* long, nearly straight, and irregularly triangular in form, and about 1½*mm* in diameter. For several days previous to its removal the patient had severe pain about the front of the head at night which ceased with the removal of the foreign body.

Dr. Dixon said that the longest foreign body he had plotted previous to this one was about 21*mm* long.

Dr. J. W. Avery presented a **specimen of melanosarcoma of the eyeball with microscopical slide of same.**

Major W. B. Lancaster (by invitation) spoke on the **work at the Medical Research Laboratory with special reference to ophthalmology.**

The work of the Medical Research Laboratory of the Air Service Division of the Surgeon General's office, may be divided into three sections.

First: Classification of Aviators on the basis of the altitude to which they are fitted to fly.

Second: Training of officers:

(a) For work as Flight Surgeons.

(b) For work at branch laboratories.

Third: Research.

The work is organized under seven departments, namely:

Physiology, Psychology, Cardio-vascular, Ophthalmology, Otology, Psychiatry, Physics and Engineering.

The Department of Ophthalmology was organized by Colonel Wilmer. In August he took the greater part of the Ophthalmic Department overseas to start similar work in France. It took some weeks to secure ophthalmologists to fill the places thus vacated. Work in the first and second sections was carried on without interruption; but research work was greatly reduced for a time. By the latter part of November twenty ophthalmologists were in training or at work at the laboratory.

The Research work in the first period consisted in trying out all the functions of the eye under conditions simulating high altitude, to see which were most vulnerable. Visual acuity, light sense, color sense, visual fields, stereoscopic vision, fields of binocular fixation, power of convergence and divergence, besides reaction time experiments of special types, were the chief lines of work.

During the second period it was planned to do some more intensive studies of certain fields which seemed to promise results bearing on practical aviation.

Captain Cobb was assigned the problem of light sense; and has designed and constructed an adaptometer for accurate work in this field.

Captain Howard was assigned the problem of estimating distance and speed, which seem to play so important a part in making landings, whereby far the largest percentage of accidents occurs.

Captain Wheeler was given the tachistoscope, as modified by Ferree, for work on problems of accommodation and adjustment, from the point of view of the time required.

Captain Dow was given the problem of constructing some improved clinical tests for light sense, in coöperation with Captain Cobb, and determining their practical value.

Major Sherman and Major Lancaster have planned a joint investigation to determine the magnitude of errors likely to result in estimating hypermetropia without cycloplegia.

A number of other problems have been considered, such as some examinations of color-blind aviators under conditions of flight, with a view to determining how great a loss of color vision is necessary to be of practical importance in the different kinds of flying,—moving-picture photographs of landings taken from the air-ship, with a view to analyzing some of the problems involved in making landings.

A careful study of the effects of smoking was also planned; but the University at which he was working could not spare the worker whom we selected for this investigation.

A reel of moving pictures was shown, illustrating some of the work at the laboratory, especially in the departments of Ophthalmology and Otology.

By Dr. ELLICE M. ALGER, Secretary.

MONDAY EVENING, JANUARY 20, 1919. DR. ARNOLD KNAPP, CHAIRMAN.

Dr. Kaufman Schlivek presented a patient with the diagnosis of a **tumor in the pituitary region,** showing with it the X-ray plates. For the past four years the child, a girl of eight years, had complained of severe headaches, sometimes as often as twice a week, and often accompanied by vomiting. Three years ago the left eye became prominent and a year ago was discovered to be blind. The family history was negative. The child was small but well nourished and mentally bright. Careful examination, both general and neurological, revealed nothing of importance. Both eyes were prominent, the measurement with the exophthalmometer being 19*mm* in the right and 24*mm* in the left. The vision in the right was $\frac{20}{200}$ and in the left there was no light perception. The pupils were equal, the right reacting to light normally, and the left very slightly, but with a good consensual reflex. The left eye was divergent and on a lower level than the right, and its motion upward and in adduction was restricted. The right fundus showed a simple optic atrophy with slight pigment changes about the nerve head. The left nerve head was white, with ill defined margin, marked vascularization, and a filled-in appearance. The nerve head and surrounding retina were elevated 1.5 D. The right eye had a temporal hemianopsia. Urine and Wassermann were negative. The X-ray examination, made by Dr. Dixon, showed in the sagittal plate what appeared to be an enlargement of the right optic foramen to 8.5*mm*, and of the left to 10*mm*. The lateral plate showed a very large sella, the least anteroposterior diameter being 17.5*mm*, and the depth 11*mm* which at that age was very large. The square planimeter content was 158*mm*. The general contour and pushing back of the posterior clinoids gave undoubted evidence of a pituitary tumor, and from the invasion of the left orbit it was probably a sarcoma.

Dr. DIXON stated that the case was sent to him as one of orbital tumor. The patient was exposed in such a manner as to throw out the orbit of the opposite side, that is, the ray was directed from about the parietal boss downward and forward through the center of the suspected orbit. This resulted in a peculiar shadow, which was apparently attached to the parietal bone within the cranial cavity and in relation to the left orbit, nothing apparently appearing within the orbit itself.

The sagittal view showed large openings in the base of the lesser wing of the sphenoid, which could only be explained by erosion of the optic foramina, these foramina rarely, if ever, appearing on a plate exposed in this particular plane.

The information obtained from these plates being insufficient to make a diagnosis, the patient was asked to return, when additional plates were exposed at varying angles. This resulted in obtaining exactly the same appearances in the sagittal view, and the lateral view showed a very marked pathological condition of the sella turcica, which gave the clue to the diagnosis.

He spoke of a case of sarcoma of the pituitary body in an adult, examined a year or so before, where the appearance, so far as the sella was concerned, corresponded to the present case. The patient died soon after, and it was reported that a large sarcoma of the pituitary body was found at autopsy.

He was of the opinion that so much erosion could only be accounted for by a malignant growth in the nature of a sarcoma; further that it was possible that the tumor, in addition to entering the left orbit, may also have traveled forward within the cranial cavity to the frontal bone.

Dr. WILLIAM M. SWEET of Philadelphia opened the subject of the evening, **substitute operations for excision of the eyeball,** with a paper on the **implantation of a gold ball.** (Dr. Sweet's paper appears on page 257.)

Dr. A. N. ALLING of New Haven, read a short paper on **the implantation of fat.** (This paper appears on page 263.)

Captain HARVEY HOWARD of Boston, read a paper describing **the implantation of a glass ball,** after a technique developed by Dr. Verhoeff. (This paper appears on page 265.)

Mr. PIERRE GOUGELMANN discussed the subject **from the standpoint of the artificial eye maker,** in a paper which appears on page 268.

In the general discussion which followed Dr. JOHN E. WEEKS presented a patient on whom he had recently performed the **Mules operation,** which is applicable in cases in which the eye is not the seat of inflammation, suppuration, or a neoplasm, and is not in a condition of atrophy.

After freeing the conjunctiva and the subconjunctival tissues from the globe throughout the zone from the corneal margin to the insertion of the recti muscles, the cornea is excised by its inclusion in a fusiform flap, the long axis being in the vertical meridian. Every vestige of the uveal layer, as well as the other contents of the globe, must be removed. The opening in the sclera is lengthened by incisions 3½*mm* long, extending from the angles of the fusiform opening in order to permit the margins of the sclera to overlap when the sutures are introduced. Six or seven catgut sutures are used to close the opening in the sclera. The sutures are made to pass through the sclera from the external surface 2½*mm* from the margin on one side, and to emerge from the lower surface of the sclera on the opposite side 2*mm* from the margin. The sutures are interrupted. After the catgut sutures are in position, but not tied, they are parted in the middle of the ellipse, and the glass or gold ball, which has been sterilized, is introduced (the Mules repositor facilitates this maneuver). The ball should be small enough to avoid any tension whatever on the line of sutures (9 to 12*mm* in diameter). The sutures are now tied, beginning with the central sutures. As the margins of the sclera are approximated, the 2*mm* margin is slipped beneath the 2½ *mm* margin and an overlapping contact secured. This ensures a board surface for adhesion. All the sutures are treated in like manner. The conjunctiva and subconjunctival tissues are then sutured in a horizontal meridian by means of silk sutures. This method of suturing the sclera and overlying tissues gives a firm union and makes it practically impossible for the artificial vitreous body to escape.

Dr. Ben Witt Key presented two patients on whom he had performed **fat implantations,** after his own technique, which may be summarized as follows:

The conjunctiva is dissected well back behind the transitional fold. Each muscle is picked up with strabismus forceps, divided, and then is sutured just behind the forceps to the transitional conjunctiva, by fine chromicized catgut sutures through both edges. A twisted silk purse string suture is inserted in the conjunctiva, after which the globe is delivered in the usual way. After bleeding has ceased, Tenon's capsule is filled full of fat from the thigh, in one piece, after which the purse string suture is tied, and both eyes kept bandaged for four or five days. The result is that the muscles, becoming attached to the transitional conjunctiva, make their traction from the side of the fatty stump which projects between them, instead of from its summit, thus copying the natural method of insertion, securing a better seat for an artificial eye, and allowing a more natural rotation.

Dr. Robert G. Reese thought that cosmetic failures were more often due to sinking in of the tarso-orbital fold than to lack of motility of the prothesis. To avoid this he was very careful to avoid cutting the lateral invaginations and aimed to cut conjunctiva and capsule in one mass, making his original incisions between the lateral muscles and the inferior rectus. Recently he had used with much satisfaction an operation, not original with him, in which he removed not only the cornea and uveal tract but also the optic nerve and adjacent sclera, thus leaving a cuff of sclera with the muscles attached and all the dangerous areas removed. He also reported a case of Mules operation in which the glass ball broke after fourteen years' wear and was successfully replaced by paraffin. He remembered an eye containing a glass ball which had to be enucleated after some years, in which laboratory examination revealed a ring of bone encircling the nerve entrance. Dr. Dixon also remembered this case, the ball being apparently eroded.

Dr. Wilson had been very much pleased with his Mules operations. He had recently seen one done over twenty years ago and completely successful so far.

Dr. J. H. OHLY was not enthusiastic over the Mules operation. He had seen a number of cases in which the balls came out sooner or later. Fat implantations had not impressed him as being much better in the end than other operations. The sometimes tedious waiting for hemorrhage to stop before implantation was possible had led him to use the snare in enucleations, as well as in eviscerations of the orbit.

Dr. C. B. MEDING thought the one factor of uncertainty in all implantations was the varying action of tissues following any surgical attack. Orbital shrinkage varied greatly not only in amount but in the various dimensions and no one could foretell it certainly.

Dr. C. C. BOYLE presented a boy of eight years whose eye had been injured by the explosion of a glass bottle. He had done an evisceration of the eyeball, and then inserted into the empty sclera a piece of sterile sponge, of quite fine texture, virtually performing a Mules operation with the substitution of the sponge for the solid sphere. The operation was done three weeks ago and was so far satisfactory.

Dr. KNAPP presented a patient upon whom a **fat implantation** after enucleation was performed eight months ago. The cosmetic result is excellent and the motility good. In his experience fat implantation gives a satisfactory cosmetic result. In performing the operation it is necessary to use a considerable amount of fat in order to fully distend Tenon's capsule and to produce an overeffect. This allows for the shrinkage which takes place to an unequal degree after the operation. It is not necessary to separately suture the muscles. They should be detached with caution, and as they slip back they are caught in the little openings through which they pass in Tenon's capsule and which become their subsequent insertions. Tenon's capsule is carefully sutured with catgut, making a vertical scar. The conjunctiva is then sutured horizontally with silk. In the after-treatment a small opening sometimes occurs and gives trouble from the protruding fat. This fat should be excised, particularly if it seems necrotic, when it appears a dirty gray; viable fat is pink and contains blood-vessels. In a case which was operated on 2½ years ago the exophthalmometer showed on the operated side 15, while the other eye was 14, adduction 2*mm*, abduction 3*mm*, movement upward 1.

MONDAY EVENING, FEBRUARY 17, 1919. DR. ARNOLD KNAPP, CHAIRMAN.

Dr. CHARLES H. SCHLICHTER presented for discussion a patient with **congenital dislocation of both lenses and very poor vision.** F. M., aged 16, a schoolboy, was brought to his clinic because of poor vision. He had reached the seventh grammar grade without the aid of glasses but the teachers and the school nurses have noticed that he seemed to have great difficulty with both near and distance vision. Examination showed V. O. D. $\frac{15}{200}$, V. O. S. $\frac{7}{200}$, which could not be improved. The iris was tremulous and a dislocation of the lenses diagnosed. The pupils were then dilated with atropin and a bilateral outward dislocation of the lens made out. The edge of the lens bisected the pupillary space. This is evidently congenital since his parents say that the boy never had good vision. The mother and father and other children of family have apparently normal eyes.

Dr. WALTER LAMBERT said that he had reported six such cases which he had treated very successfully by discission. The facility of the operation and the feeling of resistance in the subluxated lenses had surprised and impressed him very much. He was heartily in favor of the procedure in such cases.

Dr. ERVIN TÖRÖK presented a patient with **sarcoma of the ciliary body.** The patient, a woman 40 years of age, noticed six months ago that the sight in her right eye was failing. The eye was free from inflammation and there was an iridodialysis above, and the upper portion of the iris corresponding to this iridodialysis was atrophic, at the same time being pushed forward toward the cornea. A black tumor protruded from under the iris into the pupillary area covering about half of the pupil. Vision of the eye was $\frac{20}{200}$ with normal pupil and $\frac{20}{40}$ with dilated pupil. The tumor cannot be transilluminated.

Dr. S. A. AGATSTON presented a patient with **retinitis punctata albescens,** a girl of 19 complaining of temporary difficulty in seeing when coming out of a bright light into a room; this indistinctness lasting only a few seconds. The vision was $\frac{20}{70}$ in each eye, not improved by lenses. The fields were normal for white and colors, even in reduced light. The media were clear but the fundi uniformly studded with small white spots resembling verrucæ laminæ vitræ. There were no cases of blindness or of night blindness in the family. The Wassermann was negative.

Dr. J. E. WEEKS thought the patient showed better than most the characteristic fundus changes. One of his own patients had had almost normal vision.

Dr. H. H. TYSON said he had reported two cases in which the Wassermann was positive.

Dr. ERVIN TÖRÖK read the paper of the evening on **tuberculin in the diagnosis and treatment of eye diseases** (published in this issue, p. 242).

DISCUSSION: Dr. JAMES A. MILLER had always rather envied the ophthalmologist his opportunity to study tuberculosis where it could be watched and the effects of treatment observed. He had used tuberculin for fifteen years and considered it no longer as a specific but as a very useful agent. Its dangers in diagnostic doses could be avoided by care and he had never had any bad effects, while the dangers from its therapeutic use depend almost entirely on the judgment of the physician. The two conflicting theories were (1) the plan of giving very small doses, not enough to produce any anaphylactic reaction, and (2) the use of doses sufficient to stimulate this reaction as evidenced, for instance, by the opsonic index, though this had not proved accurate enough in practice, and clinical observation was the best guide. The protein substance of the bacillus, which is the active principle, is found in all the preparations of tuberculin, and he had found it advantageous sometimes to change from one to the other. He no longer used as large doses as formerly because severe reactions were harmful, though they were sometimes followed by remarkable improvement. The dose should be graduated by the severity of the focal reaction, giving enough for the individual case and keeping near to his limit of tolerance. The intracutaneous method had proved a good guide though it required close supervision. In pulmonary tuberculosis at least, the chief value of tuberculin was not so much in its immediate effects as in the added safety and permanence it secured.

Dr. Edward R. Baldwin, of Saranac, stated in a letter that his experience with tuberculin in eye diseases was unfortunately limited. The medical men in the sanitorium had lost more or less interest in tuberculin treatment and had gone from tuberculin to other lines of interest. It should not be thought, however, that this was due to a lack of belief in the value of it in a certain number of patients. In one case of recurring retinal hemorrhages interrupted tuberculin treatment had been carried out for at least five years. The patient himself pinned great faith on tuberculin and had now been going for long times without any recurrence of the retinal hemorrhages.

Dr. Lawrason Brown of Saranac wrote that from a very limited experience with tuberculin in the eye, he was impressed with the fact that patients all do particularly well with this form of treatment.

Dr. Ellis Bonime said there seemed to be some uncertainty as to the kind of tuberculin to use. Of course they were all alike in action. However, O. T. (old tuberculin) was easier to handle at the beginning of treatment as it did not produce as severe a reaction as B. E. (bacillary emulsion). Occasionally, where a patient seemed to resist the action of tuberculin, and months of treatment to have produced no appreciable result, or in a case where tuberculin constantly produced reactions no matter how one reduced the dose, a change in the form of tuberculin would sometimes clear the atmosphere and bring about the desired effect.

Secondly, the convert to tuberculin therapy was usually puzzled by the lack of uniformity in quantity expression of dosage. Milligram, minim, cubic centimeter, have been the quantity designations by different users. This has been discouraging to many. The minim was too large and, unless far greater dilutions were used, necessitated too great an increase from dose to dose. The cubic centimeter answered every purpose. All tuberculin was in fluid form and by using the *cc* we can always know how much of the original product (which is sold in *cc* quantity) was administered. The milligram dose did not apply to O. T. and required the knowledge of the amount of solid substance per cubic centimeter in order to really realize the quantity administered.

Thirdly, as to the conclusion of treatment, it was most important to know when to stop tuberculin. If stopped too soon a recurrence has been found to take place in most cases. After years of experience he found that sufficient tuberculin had been administered when 0.20 *cc* of the pure O. T. was reached. This should be followed by 10 to 30 inoculations with B. E. beginning with 10% solution and increasing rapidly until 0.10 or 0.30 of a *cc* pure O. T. was reached, depending upon the chronicity of the tubercular process. So much for the conclusion of the course of treatment, but he particularly emphasized the fact that a series of tests 3 months apart over a period of two years was necessary in order to make sure that we had gone far enough even with the above inoculations to prevent a recurrence. Experience has shown that a recurrence of susceptibility was a forerunner of a recurrence of the disease and by controlling this with a course of tuberculin we can in many instances get ahead of any recurrence of the disease.

Dr. H. R. Miller said that tuberculin was not an antibody in the strictest sense of the word; and therefore not a true specific. It possessed, however, curative properties and this manifested itself in acting through the focus of disease in actively immunizing the body. It was obvious, therefore, that for tuberculin to be potent there must be present a focus of tuberculous disease, and that a so-called cure depended upon the response for cure produced in this focus of disease. It was also a fact that the tuberculous body can be made more and more tolerant to ever-increasing amounts of tuberculin; this being in some sense an immunizing process. The basis for tuberculin therapy then depended upon these two factors: namely, (1) that it worked through the lesion already present; (2) that it may be tolerated in increasing amounts by the subject; and our aim was to so increase the tolerance of the tuberculous body to enlarging doses of tuberculin as to render harmless the toxins liberated in the focus of tuberculosis.

Several theories have been advanced to explain the action of tuberculin, the one most generally accepted being the theory of hypersusceptibility. It has been claimed that the tuberculous body possesses an altered capacity to react to freshly introduced tubercle bacilli; in other words, to reinfection, and similarly, that the tuberculous host possesses the same altered capacity for reaction to tuberculin. This has been spoken of as "allergy."

For the ophthalmologist it was significant to realize that he was dealing with a circumscribed, so-called, attenuated tubercular lesion, and that it was, therefore, possible for him by the use of tuberculin to call forth healing responses already present in the patient without running any marked danger of producing constitutional or undesired systemic effects.

Dr. J. G. Dwyer said he would discuss the subject from both the laboratory and clinical standpoint. From the laboratory side we must remember that the exact way in which the tubercle bacillus acts is unknown and the nature of tuberculin is unknown in its real essence. The opsonic content mentioned by Dr. A. Miller is of very little if any importance in the immunity against this organism as very often the patient's opsonic count is above normal and the lesions still progress. Again we must remember that the body infected with tuberculosis manufactures its own tuberculin and we only aim to increase the amount of this in suitable cases. From the clinical standpoint there are several very important practical points to be kept in mind and the speaker would quote from his experience of about ten years as to the essential points always to be kept in mind. In the first place the cutaneous reaction has only a very limited field of service and a positive cutaneous reaction is of diagnostic significance only in a patient who is not old enough to have suffered from any form of tuberculosis and to have recovered from it—hence it is of value in young children only. A negative cutaneous or von Pirquet is of far more significance, as an evidence of the absence of tuberculosis, past or present. The test of choice is the subcutaneous and in order to employ this it must be done under the proper conditions or it is useless. It should be done always under direct medical supervision and, as pointed out, the local focal and general reaction must be watched for and properly interpreted.

The kind of tuberculin does not matter—the important thing is for the physician to have an intelligent appreciation of the underlying principles of tuberculin therapy, its limitations especially, and until this fact is understood, harm will result from its unsuitable application. The type of case and the dosage is of far more importance than the kind of tuberculin.

Tuberculin is one of the best therapeutic agents that we have when suitably applied and one of the worst when used in unsuitable cases and unsuitable dosage.

Dr. WEEKS. In my experience the presence of tuberculosis of considerable extent in other parts of the body appears to retard recovery in the tubercular affection of the eye. I have had one case of rather extensive lung tuberculosis which was not very active, but the lesions of which were very evident in the X-ray plates of the lungs, in which the tuberculosis of the eyes (both corneæ and adjacent scleræ were affected) was influenced extremely slowly by the tuberculin. I have also one case of tubercular double irido-chorio-sclero-keratitis accompanied by tubercular ankylosis of a knee joint, in which the treatment with tuberculin has affected the eyes extremely slowly. However, the condition is surely approaching inactivity. It has appeared to me that in advanced adult life the response to the use of tuberculin is not so rapid as it is in children and young adults.

What are the reasons of failure? A number of cases of tuberculosis of the eye have come under my care in which tuberculin has been used with alternate improvement and relapse, and some in which the condition, although suspected to be tuberculosis, has been pronounced non-tubercular after a prolonged use of tuberculin. In my experience the chief source of failure is neglect of regularity in administering tuberculin where a reliable preparation has been used, and in other cases due to the failure to use a reliable tuberculin. In regard to the first, it is absolutely necessary that the tuberculin be used regularly and efficiently until the tuberculous process is at an end. If the tuberculin is used in a haphazard way the tubercle bacilli will not be destroyed but will grow in the interval of neglect, and the result will be only an intermittent inhibition. In the second place, the tuberculin used must be determined to be efficient, as shown by its effect on the patient. If improvement does not continue a different form of tuberculin should be used until one is found that will produce improvement.

The essentials of success are (*a*) regularity in the use of tuberculin until the process ceases to show any signs of activity, and for a period of some months afterward; (*b*) the use of a tuberculin that is up to the standard strength, in sufficient dose to influence the system just short of a general reaction.

In regard to the tuberculins to be employed, any of the standard tuberculins may be efficient. In their use it has been my custom to inject them into the loose subscapular areolar tissue, sterilizing the skin with alcohol or tincture of iodine, and sealing the puncture with collodion. I have no doubt that equally good results will be obtained if the tuberculin is injected into subcutaneous loose areolar tissue in any part of the body.

Dr. Coleman W. Cutler presented a patient with a **conglomerate tubercle of the choroid,** a man of 34 years, whose left eye had been failing for three months. His general health was good and the various tests, including Wassermann, were negative. The appearance of the mass covering the macular region of the left eye was that of a subretinal tumor, grayish white, without appearance of stroma, rising abruptly to an elevation of 4 to 5 D. In size about double the diameter of the nerve head vertically and horizontally. The retinal vessels crossed over it unbroken. There was much œdema between it and the nerve, and upwards especially, where the vessels were in places covered by whitish flocculent masses. When first seen, there were no hemorrhages. Tuberculin was begun October 25th with 4 min. of the first dilution of B. E. (Mulford), and cautiously increased. There seemed to be occasional increase of œdema with small hemorrhages and a surrounding ring resembling circinate retinitis, at some distance from the tumor itself, became more evident. The doses were increased with little change until on February 11th, when he was last seen, the tumor was sharply circumscribed, about 4 D. elevation, no hemorrhages or reactionary œdema.

This case was undoubtedly one of solitary tubercle. The tumor has not been notably reduced in size by the use of tuberculin, although the surrounding œdema and irregular deposits in the retina have diminished. Cases are reported which without treatment have diminished in size and undergone cicatricial changes. In fact it is the rule in isolated tubercular choroiditis, which we see not infrequently, for the deposit to undergo retrogressive changes and run its course, leaving an atrophic spot, without treatment with tuberculin but with due regard to the hygiene and general health of the patient. This, of course, is analogous to the healing of tubercular foci in the lungs and elsewhere under favorable conditions of life and should make us somewhat guarded in the claims that we make for the favorable action of tuberculin, which have been made with such confidence, often justifiable, in ocular lesions of the most varied sort.

Dr. Cutler wished to state briefly his opinion that: 1. No case should be subjected to the massive diagnostic injection without a very careful physical examination, if necessary with radiographs of the chest before the test and afterwards, especially if there is a reaction. Dr. Miller's statement that he has seen no ill effects from tuberculin is certainly most reassuring. 2. In most cases of corneal and iris tuberculosis in children, which form by far the greatest number of the patients, it has not seemed necessary to use large diagnostic doses at all. If syphilis is excluded, the diagnosis is not difficult in most cases, and usually the improvement after a few weeks of the B. E. is conclusive. There are exceptions to this rule, but it should be borne in mind that in *diagnosis* violent reactions are not necessary, and may be dangerous, and that the physical signs should be watched with the utmost care, and that in *treatment* reactions are detrimental and the best effects are obtained by small doses of tuberculin with gradual increase, omitting a treatment or reducing the quantity when the slightest sign of hyperæmia appears.

In one case, a child of 8, with marginal and central corneal opacities, of the familiar deep phlyctenular type, and with considerable vascularization, was given tuberculin beginning with 2 min., which was gradually increased to 8 min., when she had a severe reaction during which the corneal condition became very much worse, the ulcers larger, the vessels more numerous. With this there was much swelling of the accessory lacrimal glands, slight swelling of the parotid, none of the submaxillary, quite suggestive of Miculicz' disease. Temperature rose abruptly to 104° F. The recession was gradual. Tuberculin was resumed after the eye had become pale and the condition about as at first. Again, after the tuberculin had reached about the same strength, a reaction was produced, not as violent as the first and without swelling of the accessory lacrimal glands. She has received no tuberculin since. There was no obvious improvement in the corneal lesion, which showed a tendency to advance towards the pupillary area, which has been controlled by cauterization and calomel. This child is evidently so sensitive to tuberculin that its use would be dangerous. She is fat and well nourished, ruddy, and apparently normal.

Another girl, of about 14, with corneal and iris lesions which are chronic, showing no signs of vascularization, with a large cervical gland, has received increasing doses of tuberculin for several months and has now commenced with the third series without any signs of reaction and with very striking improvement in her general condition. The size of the gland has diminished one half, the iris nodule has disappeared and the cornea is much clearer, with entire absence of photophobia.

These cases, which present many interesting features that cannot be given in detail here, show the necessity for individualizing in both diagnosis and treatment.

Dr. A. E. Davis said there were one or two points he would like to emphasize.

First, as regards diagnosis, in all cases where the etiology was in doubt, the tuberculin tests should be used routinely, just as the Wassermann test is. His practice was invariably to make the von Pirquet test in adults as well as in children. If this very delicate test proved negative, it eliminated at once one etiologic factor, tuberculosis; if the test was positive, or partially positive, the subcutaneous injection of O. T. should be given, the first dose being one half *mg.;* if this proved negative, then two *mg.*, and in the event this proved negative, five *mg.* If no reaction was obtained, then again, tuberculosis was excluded. He was somewhat surprised that the von Pirquet test was not more widely used in adults, being a very simple test to make, and if negative, definitely excluding tuberculosis as a factor. If positive, of course, it must be supplemented by the O. T. injections. Second, as to treatment. He used the H. K. Mulford serial dilutions altogether, the B. E. and O. T. mixtures. Formerly, he used the B. E. mixture almost exclusively, for therapeutic purposes, but lately had gone to the use of O. T. preparation. He began with the smallest dose (2 min.) of the weakest (No. 1) dilution, and increased 2 min. a dose, until the maximum dose (20 min.) of the No. 1 dilution was given, or until he got a mild reaction. If this reaction was not obtained with No. 1 dilution, then he used No. 2 dilution, beginning with 2 min. and increasing as with No. 1 dilution, and so on through dilutions Nos. 3 and 4, until a reaction was secured. This was indicated by a mild rise of temperature, one half to one degree, a slight redness at the site of the injection, and perhaps a mild focal reaction in the eyes. We should be exceedingly careful, however, how we stirred up focal reactions in the eye. He believed in getting mild reactions, however, because he did not understand how those who do not believe in getting reactions ever know when they are up to the physiological dose of the vaccine. He thought reactions were necessary, first, as a guide as to the physiological tolerance of the patient, and, second, to secure the full effect of the remedy.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By Mr. H. DICKINSON, London.

An ordinary meeting of the Section was held on Wednesday February 5th, under the presidency of Mr. W. T. Holmes Spicer, M.B.

Mr. A. C. Hudson showed a patient who had **retinal degeneration** following the presence of an intraocular foreign body. The appearance presented was that of folds in the internal limiting membrane of the retina, probably, the author thought, as a result of contusion of the eye. Some of the lines could be seen to pass in front of certain of the retinal arteries: they also seemed to have a faint stippled appearance. Those were his reasons for placing the location in the internal limiting membrane, rather than regarding them as folds in the retina itself. He thought the lines indicated a pathological condition, and that the optic disk presented signs of having been œdematous. He had seen similar appearances in a case of retinitis pigmentosa, the folds there having occurred as a result of traction in the retina: also in a case of contusion of the whole of the macula, the retina in that case appearing to be absent except the portion which was represented by the double-contour line. He regarded these appearances as exactly analogous to the peculiar double lines one could see in some posterior capsules after cataract extraction: they were also analogous to the striæ seen in the cornea in striate keratitis following injury in the cornea, again due to the folding of a thin elastic membrane—Descemet's.

Mr. J. Herbert Fisher said that in support of the exhibitor's idea that they were a new formation was the fact that the patient was definitely blind in his remaining eye for a considerable time after he was hit. That suggested some definite lesion, probably in the fundus oculi, and as there was chemosis on the anterior part of the globe, the central œdema was perhaps considerable. With regard to the evidence of past œdema in the head of the optic nerve, the retraction of the nerve was 3 to 4 diopters, and the congested appearance might not be due to recent change.

Mr. A. W. ORMOND thought the amount of swelling was much greater in the upper than in the lower part of the disk, and he regarded the condition as pathological. He had seen a like appearance in a case of injury on one side of the head, and looked upon it as due to the force of the blow.

Lieut.-Colonel DONALD ARMOUR and Mr. WILLIAM LANG showed a patient from whom an ivory exostosis of the orbit had been removed by Colonel Armour through the cranium. The patient attended at the Royal London Ophthalmic Hospital, where the staff decided it was a case for a general surgeon. Colonel Armour admitted him into Queen Square Nerve Hospital, and operated. After studying the skiagram, he decided that the best procedure was to make an osteoplastic flap and turn it over the frontal region, its base being at the supraorbital margin. He turned down bone and scalp together. That displayed the cranial portion of the tumor, which was indenting the under surface of the frontal lobe. By pushing the dura and brain gently back over the summit of the tumor, he could see the whole extent of its cranial portion. The tumor seemed to be fixed to the supraorbital margin, but it proved not to be so, and could be levered away. Part of the removal was accomplished with chisel and hammer, and where the roof of the orbit was implicated, removal was effected piecemeal by cutting forceps. Complete recovery ensued, vision was now normal, there was neither diplopia nor fundus change, and, except for the scar, nothing remained to show that an operation had been done. Judging by the covering of mucous membrane at one portion, it must have been growing from the frontal sinus. There was no evidence that the operator had broken into the frontal sinus, but on the day following the operation, and on the succeeding day or two, there was an escape of blood from the nostrils, but the sinus was apparently aseptic, as nothing further happened.

Colonel Armour was heartily congratulated.

Mr. J. F. Cunningham exhibited a case of **cartilaginous tumor of the orbit,** which Colonel Armour recommended operation for.

Mr. Elmore Brewerton showed a case of **angioma of the retina.** He referred to previous cases of the kind which had been exhibited and said he regarded this one as a cavernous angioma. The disease seemed to reside in the oval swelling in the periphery. These cases were, nearly always, in young adults or children, and they might be of congenital origin. There seemed to be congenital faulty development of the capillaries in that part of the retina, these capillaries dilating into cavernous spaces, resulting in an oval limited area of angioma. The rest he regarded as merely mechanical in causation. In proof of that view was the fact that branches coming off were normal in size and general appearance. This was the lad's only eye, and Mr. Brewerton did not regard the prognosis as good: he feared leakage, and already there was slight exudation at one spot. He would probably have an intraocular hemorrhage, which might clear up, but a second such accident would deprive him of his sight. At six years of age, the other eye was removed as it was not only blind but painful.

Mr. A. W. Ormond regarded these cases as very interesting because of the relationship to the other eye. He had a similar case in a soldier, who at 5 years of age had an eye removed for what was considered to be a growth, but which turned out not to be so. The condition seemed akin to what Coats described as massive exudation of the retina.

Dr. James Taylor read a communication entitled **changes in the sella turcica in association with Leber's atrophy.** The object of the paper was to exhibit skiagrams of the pituitary fossa in a well marked case, and to support the thesis advanced by Herbert Fisher as to the connection of this disease with sexual abnormalities. The chief changes seen skiagraphically were in the posterior and anterior clinoid processes.

The President considered that this paper took the profession a step further on the subject: it would be a great comfort if the origin of Leber's disease could be definitely known. It was scarcely to be expected that the only abnormality in connection with it was in the sella turcica. The series of observations made by Ogilvie years ago on the large number of deaths of children in families afflicted with Leber's atrophy seemed to point the direction which future investigations should take.

Mr. J. HERBERT FISHER referred to his paper in which he first made the suggestion that Leber's optic atrophy was probably due to implication of visual pathways by the pituitary body when that gland was undergoing excessive physiological changes in association with sexual development or decline. Since he published his paper, he had had a remarkable case in a woman who prematurely reached the climacteric at 37 years of age, and a year or two afterwards her vision failed, with the characteristic changes in the disks, and definite changes in the sella turcica were seen in the skiagram. There seemed no reason why sporadic cases, apart from family tendency, should not be found, answering the same cause. In such families there was, usually, a high infantile mortality, which seemed to point to some syphilitic taint. The pituitary was a body essential to the continuance of life: if extirpated, the animal died. Hence disorder of the pituitary body seemed consistent with early death.

Dr. W. WALLACE (late Captain) showed, by means of the epidiascope, a remarkable series of his drawings in water-color of fundus changes resulting from war injuries. He was highly commended for them, and offered to present his whole collection of drawings, the result of many years' work, to the profession.

Professor HERBERT PARSONS hoped the drawings would be made the nucleus of an ophthalmological atlas to commemorate the work done in the specialty during the war.

Mr. FOSTER MOORE read a paper on a case of **sympathetic ophthalmitis with fundus changes.** The patient had a puncturing wound of the right eye, with prolapse of iris and ciliary body. The prolapse was removed, and, a fortnight later, the eye was enucleated. Twenty days after removal of the eye, its fellow started to be a little misty. There was, soon after, some tenderness of the eye on palpation, and a fine deep haze in the lower part of the cornea. The veins were somewhat distended, but the fundus was normal. The blood count was normal. A skiagram negatived the idea of a foreign body being in the eye, and Wassermann was negative. Keratitis punctata spots appeared: five doses of neo-salvarsan were given. At one time vision fell to $\frac{6}{60}$. He did not think the neo-salvarsan had any influence on the disease, and he quoted the conclusion of a special Committee of the Ophthalmological Society, some years ago, that mercurial inunctions had "no decidedly bad effect" on sympathetic ophthalmitis.

Mr. Frank Juler, who made the drawings of the case, added the results of his observations.

OXFORD OPHTHALMOLOGICAL CONGRESS

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March, 1919.

PRELIMINARY NOTICE

DEAR SIR:

The Oxford Ophthalmological Congress will assemble at Keble College, Oxford, on the evening of **Wednesday, July 9th, next,** and the Meeting will be held on **Thursday, the 10th,** and **Friday, the 11th July.**

The first day, Thursday, the 10th, will be largely devoted to a discussion on "PREVENTIVE OPHTHALMOLOGY," to be opened by Colonel J. Herbert Parsons, A.M.S., Consulting Ophthalmic Surgeon to the Forces.

Members intending to take part in the Discussion are requested to kindly send in their names to the Hon. Secretary at their early convenience.

The second day, Friday, the 11th, will be given up to papers, demonstrations, and cases, etc.

It is hoped that members will make every effort to contribute to the success of the Meeting with cases, specimens, new operations, or novelties of any kind. If, therefore, you have any such that you are willing to bring forward will you kindly notify the undersigned at the earliest opportunity and your contribution will be welcomed.

The Annual General Meeting will be held in the evening of Thursday, July 10th.

Yours faithfully,
BERNARD CRIDLAND,
Hon. Secretary.

Salisbury House,
Wolverhampton.

VOL. XLVIII. . NO. 4.

ARCHIVES OF OPHTHALMOLOGY.

AUTOGENOUS ONE-PIECE EPITHELIAL GRAFTS FOR THE RESTORATION OF THE EYELIDS[1]

BY DR. EDWARD B. HECKEL, PITTSBURGH, PA.

(With six illustrations on Text-Plates Nos. IX. and X.)

WHILE the present communication may contain little that is new or original yet the writer feels justified in presenting or repeating a technique which has served him well during the last ten or fifteen years. It was the writer's privilege to present a communication upon the restoration of the eyelids to this section, when our State Society met here in Philadelphia some years ago, detailing the technique and reporting several cases; since then it has been the writer's privilege to further demonstrate and improve the technique and good results described at that time. In addition to all this, the present time seems especially fitting to call your attention to the correction of a deformity which may, in the near future, be decidedly more common than in the past.

In the natural course of our industrial life, for peace hath its victims no less than war, it is not uncommon for accidents to result in more or less destruction in facial contour. Eyelids are torn, lacerated, and often destroyed as the result of burns.

Fortunately these burns, while severe, as a rule destroy the skin and a portion of the substrata only, leaving the underlying muscles intact. The real deformity results from the immense contraction following the skin destruction, producing an eversion of the conjunctiva and a constant and persistent exposure of the eyeball, which, if not corrected, will result in a destruction of the transparency of the cornea and in an eventual loss of vision and often of the eyeball itself.

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[1] Read before the Section on Eye, Ear, Nose, and Throat Diseases, Medical Society of the State of Pennsylvania, Philadelphia, Pa., September 24, 1918.

The problem then becomes a very simple one, for all that is necessary is to so separate the resulting cicatrix as to expose and replace the contracted muscles to their former position, cover them with an epithelial layer to keep them so, and the desired result is obtained, not only a restored lid, covering and protecting the eyeball, but a normally functionating lid responding to all the physiological movements of the normal lid. While this statement is perfectly true in every respect, the real problem is to so cover the defect that when the final shrinking or contraction in the graft has taken place it will be sufficient. In the previous communication, already referred to, the writer drew especial attention to the immense shrinking which takes place in these grafts, and again emphasizes it now, for good results depend entirely upon how adequately this shrinking has been anticipated.

The choice between an epithelial graft and a whole-skin graft or transplantation with or without a pedicle, in cases such as these, needs no argument, the facts speak for themselves; the epithelial graft results in a thin pliable skin surface, which in some instances, especially in the negro, can scarcely be distinguished from the surrounding normal skin, while the whole-skin transplantation or graft is more or less thick, bulky, and in itself a deformity.

The routine followed in these cases is as follows: On admission to the hospital, preparatory to the operation, the patient is given a full bath, the head is shampooed, and the face is ordered to be carefully washed with rather warm water and soap three times daily for three days. The patient's alimentary tract is looked after and his diet is restricted. The skin of his arms is carefully inspected. The one showing the cleanest skin, free from defects, etc., is the one selected from which the graft is to be taken. This arm is then ordered to be "scrubbed" daily for three consecutive days with

ILLUSTRATING DR. HECKEL'S ARTICLE ON "AUTOGENOUS ONE-PIECE EPITHELIAL GRAFTS FOR THE RESTORATION OF THE EYELIDS."

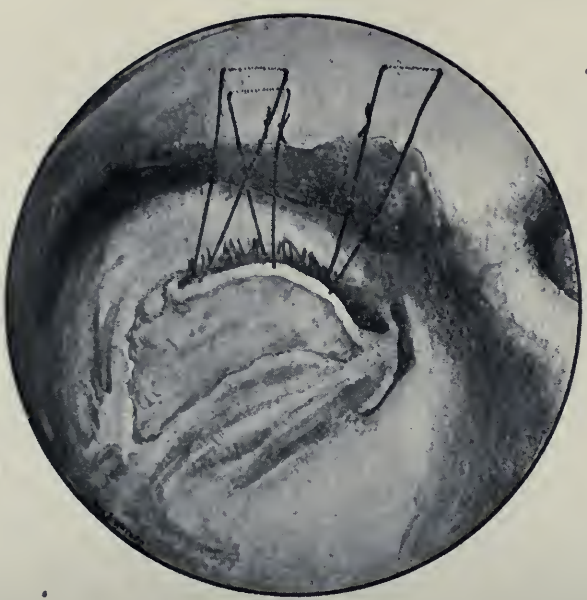


FIG. 1.

After dissection, overcorrecting deformity so that lower lid is carried over upper lid and held in place by sutures.

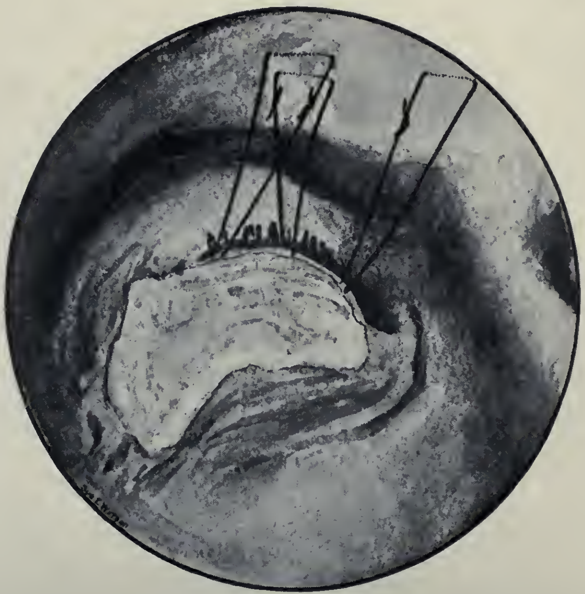


FIG. 2.

Denuded area covered with skin graft.

the "scrubbing" of the face, and after each scrubbing with hot water and ethereal soap and a rinsing with alcohol, the arm is covered with sterile gauze and bandaged. The final or third bandage is allowed to remain until the graft is to be excised or shaved off. On the fourth day the patient is ready for the operation. During the preparation neither the eye nor the face is covered at any time with a dressing. If the exposed conjunctival surface is dry or irritable a bit of bichloride vaseline 1:3000 is applied several times daily to keep it moist.

A general anæsthetic is used as it is very desirable to have all the muscles thoroughly relaxed. Ether is the anæsthetic of choice and during the administration of this the eyes are carefully covered with sterile gauze.

The operation conveniently divides itself into the four distinct stages:

1. Dissection of the lid so as to expose and prepare the underlying muscles.
2. Fixing the lid in a stretched position by anchoring it with several guy sutures.
3. Excision of the graft.
4. Placing of the graft in position, dressing, and bandage.

The first incision is made parallel with and about 3*mm* from the lid margin, or if this has been destroyed, from the conjunctival border, cutting just deep enough to cut through the skin or scar tissue, and extending it along the entire length of the lid or at least well beyond the point of eversion.

This gap is carefully widened by dissecting superficially the skin beyond and through the entire length of the incision. The lid margin is then grasped and pulled up or down as the case may be, up if a lower lid, down if an upper lid, and the dissection carried on till the lid can easily be stretched to a point far beyond the requirements of the lid, so that the middle part of the lid margin can be placed as far above the normal line as it was below it in its preoperative state. (See Figs. 1 and 2.)

The bleeding from the raw surface is easily controlled; if there are any small spurting points these can be grasped and twisted slightly with small artery forceps, the general oozing yields promptly to a few hot wet pads.

There is of course a decided redundancy in the length of the lid margin, depending upon the case; sometimes the length is increased to almost twice that of normal or what it originally was. This increase is simply the result of a stretching process and nature takes care of it very nicely after the operation and it should never be interfered with; that is, to attempt to excise a V-shaped piece is absolutely wrong and should never be done. The final shrinking takes care of this as will be illustrated by pictures shown.

The second step in the operation consists of stretching and anchoring the lid. A strong silk suture is used for this purpose with a needle at either end. First one needle is passed through the middle of the lid at the greatest width of the defect to be covered, by passing the needle parallel with the plane of the lid from the raw surface at about the middle of thickness of the lid margin; the other needle of the same suture is passed in a like manner about 3*mm* from it. One needle is now unthreaded and the other, after holding the suture taut and putting the lid on a stretch, is passed either in the forehead or upon the cheek, depending if it is the upper or lower lid, and the two ends tied so as to hold the lid stretched. In addition another similar guy suture is inserted on either side so as to put the entire lid upon a stretch. This is then carefully covered temporarily with a wet pad of cotton. (See Fig. 2.)

The third step consists of excising or shaving off the epithelial graft.

The dressing is removed and the prepared arm exposed. It is again washed with hot water and ethereal soap, flushed with alcohol, and finally copiously douched with warm normal salt solution.

The arm is firmly held by an assistant. In order to put the skin surface on a stretch and flatten it so as to facilitate the removal of the graft, two pieces of wood are used; one is held by an assistant, the other by the operator. These pieces of wood are 2½ by 5 by ¼ in. and have been previously sterilized by boiling. The graft is then shaved off by means of an ordinary razor, rather broad and sharp. The blade is held parallel with the surface of the skin and is so directed as to shave off a thin section only, just cutting off the papillæ of the true skin. With a little care, it is quite a simple matter to get a one-piece graft of more than sufficient size to cover the defect. The excised graft is immediately placed in a warm normal salt solution. The raw surface on the arm is dressed by placing over it a sterilized piece of gauze, over which some bichloride vaseline 1:3000 has been smeared and which is confined by means of a roller bandage. This dressing is not disturbed for several days, after which it is redressed at intervals of a few days. Healing and epithelialization is quite prompt and perfect, so that little or no scar remains.

The fourth step is the placing of the graft. The raw surface is now again exposed and should be dry, clean, and free from any bleeding.

The graft is now carefully spread out over the raw surface to be covered and carefully pressed into place. The portions extending beyond are carefully excised with small sharp scissors, being careful to allow a little overlapping, in other words the graft should be just a bit too large all the way round. (See Fig. 2.) The graft is then covered with a piece of gutta-percha tissue, cut so as to be a little larger than the graft and perforated at a number of places by nicking with scissors. A bit of wet cotton is now carefully molded into a shape as large as the gutta-percha tissue and about a quarter of an inch thick, being careful to get it of an even thickness; this is then carefully placed over the gutta-percha tissue. Then this is covered with a piece of gutta-percha tissue without perforation, so as to prevent the underlying cotton pad from drying out too soon, which is in turn covered with a pad of sterile gauze slightly larger than the other pads; then this is held in place by a few adhesive strips so as to prevent any slipping during the placing of the rest of the dressing and bandage; over this is placed a rather large pad of sterile gauze about 2½ by 5 inches and over this a similar pad of cotton; the ear on the corresponding side is protected by cotton and the whole confined by means of a two-inch roller bandage, carefully but firmly applied by including the ear.

It is very important to apply the roller bandage with care as it is very essential, in fact it is absolutely necessary, to so apply it that the bandage will not slip.

This dressing is allowed to remain from four to seven days. If the patient is comfortable, the bandage nicely in place, and no odor, it is better to let it remain six or seven days. The chief essential for the taking of the graft is that it be held firmly and evenly in place.

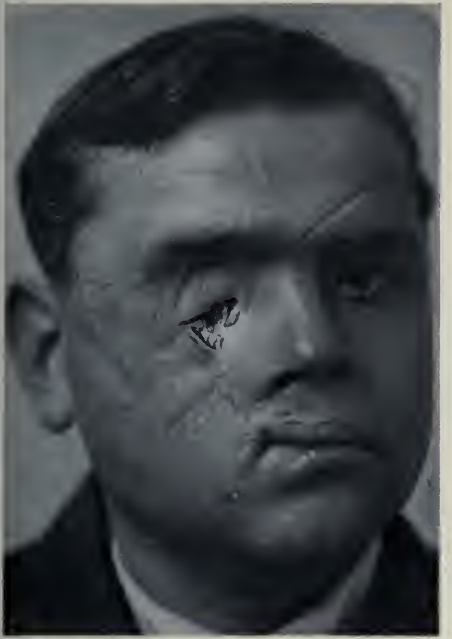
At the end of from four to seven days the dressing is carefully removed and carefully washed off with a warm normal salt solution. At the same time the conjunctival sac can also be flushed out some. If the guy sutures are still in place (sometimes one or more are found to have cut through the lid margins) they may remain for another day or two, but not longer. The second dressing should be done in the same manner as the first and daily thereafter for three or four days, after which the bandage may be omitted and the graft thoroughly covered with bichloride vaseline 1:3000 and the entire area protected by a wire gauze protector.

The eye is flushed and cleansed once daily thereafter for about one week when the wire gauze protector may be omitted. The bichloride vaseline is continued however and when the patient leaves the hospital after about two weeks he is given some bichloride vaseline 1:3000 and asked to anoint and massage the grafted surface several times a day; this is continued for some weeks.

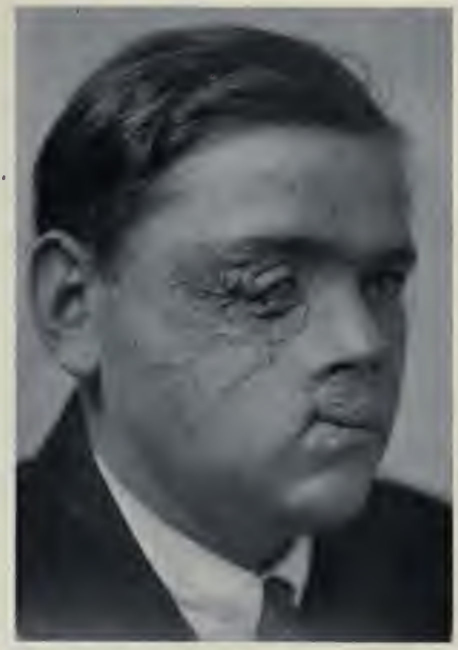
From the description of the technique it goes without saying that when both eyelids are involved the operation must be divided, as it is impossible to attempt to restore both lids as the result of one operation.

The cases shown in the accompanying pictures serve to illustrate the paper.

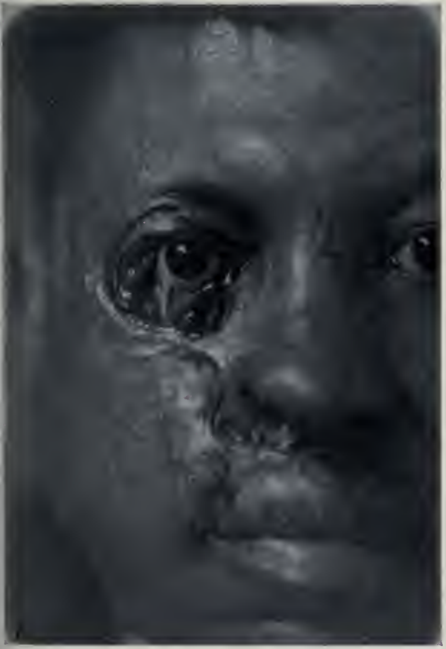
ILLUSTRATING DR. HECKEL'S ARTICLE ON "AUTOGENOUS ONE-PIECE EPITHELIAL GRAFTS FOR THE RESTORATION OF THE EYELIDS."



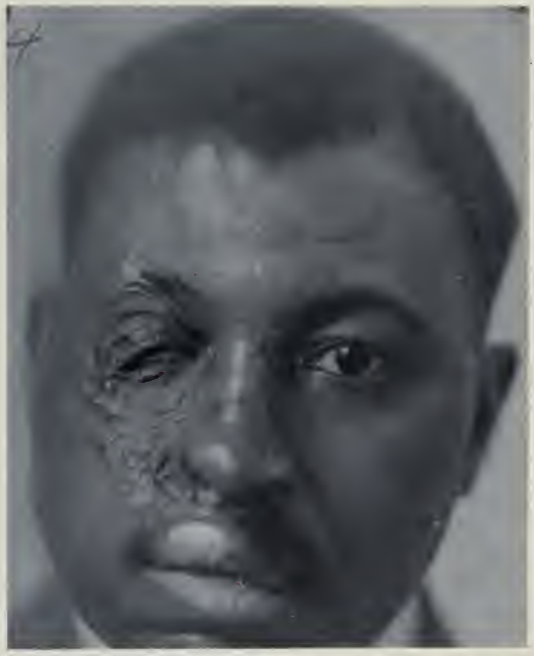
Before Operation.



After Operation.
Operation done December, 1914.



Before Operation.



After Operation.
Operation done April and May, 1917.

REVOLVER BULLET INJURY OF BOTH ORBITS WITH MANY EYE SYMPTOMS. PRESERVATION OF VISION IN ONE EYE, THAT OF THE OTHER REMAINING USEFUL, BUT BELOW NORMAL.

By Dr. JAMES A. SPALDING, Portland, Maine.

IT may seem hardly worth while with so many much more interesting accounts coming from overseas of cases of bullet injuries of the orbits, with all their manifold symptoms, to publish in the Archives just a single instance of such an injury occurring in civil life. But as this single instance offered some unusual symptoms and ophthalmoscopic appearances, and has been observed for verification off and on for several years, it really seems as if it ought to be published in order to add one more to the list of cases already available. In due season we shall have the pleasure of reading a complete surgical history of all the orbital bullet injuries occurring during the Great War, so that it is unnecessary in this brief paper to tabulate the bibliography of other similar cases already published in scattered papers of the past. For all of those, too, will undoubtedly find a place and a mention in the new war histories sooner or later to be printed for reference and careful consideration and study. A brief suggestion, however, concerning the ultimate results in some of the civil injuries of the orbits already reported will find mention for the reader as he proceeds.

A young fellow was tossing carelessly from one hand to the other, and even throwing into the air and catching with either hand as it fell, a small caliber pocket revolver with five chambers. A bystander remonstrated with him for being so careless, but he replied: "Oh, that is nothing. I know that I can catch it every time that it falls and with either hand any time, and beside that, it isn't loaded. Just look at me."

So saying, he put the muzzle against his right temple, and pulled the trigger. Instead of the mere dull click of the hammer on the breech or on an empty cartridge, there was an explosion, the man fell to the floor shrieking hysterically, became unconscious, and after first aid had been given by a local physician, he was carried to a hospital. An X-ray picture was taken the next morning, and as it was a partial failure, another was taken and at this second attempt a small caliber bullet, somewhat stripped of lead so that it appeared smaller than when it entered the orbits, was discovered in the left orbit, very deeply seated and tilted on its larger end.

When the patient finally came to his senses he began to exhibit various eye symptoms, and it fell to my lot to be called in, in consultation with the attending physician.

I found the patient very hysterical, fearing blindness, and very difficult to manage, but by gentle persuasion he became after a day or two, more tractable, and I was finally able to make out the following state of affairs:

First, was the small circular temporal wound where the bullet had entered and surrounded by many tell-tale grains of unexploded powder showing the closeness of the muzzle of the revolver to the skin when fired. This aperture I may say soon healed over and required no surgical care at all.

As to the eyes the first striking symptom was excessive œdema of both lids of both eyes, although more marked in the lids of the right eye than of the left. It was with difficulty that the lids could be held apart, at all, with the fingers of the attending physician. Once partially opened, the eyeballs appeared to be protruded somewhat, the right eye more than the left. The œdema and the protrusion of the eyes were attributed to an abundant orbital hemorrhage. As the œdema gradually decreased, it was noticed that the patient could only look upward by throwing back his head, all motion of the eyeballs upward being impeded by the swollen condition of the lids.

As this œdema gradually decreased and finally ceased within a week, further observations were made as follows:

The conjunctivæ exhibited a curious subconjunctival hemorrhage in each eye, that on the right eye being limited very accurately to the course of the sheath of the external rectus, and extending backward in ribband shape out of sight in the orbit no matter how far the eye was turned in toward the nose. The hemorrhage in the left eye was limited partially to the sheath of the external rectus, as in the other eye, but there was, additionally, a considerable hemorrhage above the cornea. These two hemorrhages on the left eye it may be said, in passing, gradually decreased in size and coloration, and gradually disappeared from view, as they invariably do, but that of the right eye lasted several weeks before it was finally lost to sight.

The cornea of each eye was transparent but totally anæsthetic; both pupils were dilated, the right, ovally upward and responsive to light, the left, widely circular and not responsive to light in the least. Pilocarpin and eserin, 1%, caused each pupil to contract to minimum but the left pupil widened again ad maximum and has remained larger than the right in the several years since the patient was first examined. The corneal anæsthesia diminished rapidly as a symptom.

The media were transparent in both eyes.

As the patient complained bitterly of seeing everything double, and confused, examinations in that direction were made as soon as the lids could voluntarily be opened to ordinary width, the eyes being covered with red and green lenses, respectively. The images were thus brought out distinctly when tested with a candle, and they revealed the symptoms of paralysis of the left inferior oblique, as prefigured in the textbooks on the eye muscles. During these tests, also, a defect in the visual field in the left eye was discovered, the patient expressing himself to this effect: "If I shut my left eye and look at you as you stand there at the foot of the bed I can see you plainly and all over, but if I close my right eye and look at you with my left eye, I can only see your body and the upper part of your face about as high as the lower rim of your spectacles. Above that, everything is blind to me."

In two weeks from the time that this visual field defect was first noted it had practically ceased so that the two eyes were in that respect about alike.

We come now to the curious part of the case, the extraordinary ophthalmoscopic appearances which were very clearly defined owing to the perfect transparency of the media.

The papilla of the right eye was normal as to contour and vessels, but directly above it and of about the same diameter and attached to it was a circular white exudate through which the vessels could be plainly seen. It was about two thirds of the papilla diameter and as white as the exudates shown in Lagrange's recent pictures in his work on orbital injuries during the war. Directly below the papilla was a larger exudate also very white and shiny which covered the vessels emerging from the papilla entirely out of sight, those on each margin of the exudate being just visible. One of the veins on the margin was exceedingly large and tortuous. There were a few minute retinal hemorrhages in this eye only.

The exudate on the left papilla was like that on the right, but smaller and only visible above. Below, the retina was normal without any exudate.

It was soon noted that the exudate was decreasing in thickness, in that the hidden vessels began to come into sight, to emerge, as may be said, so that after some months they were all plainly visible.

A year later the exudate in the right eye was about one third of its former dimensions and all of the vessels could be easily followed as they emerged from the papilla. The exudate in the left eye had disappeared entirely. The sight of the right eye as repeatedly tested was perfect and there was no scotoma discoverable. The sight of the left eye was about $\frac{20}{80}$ and has remained so in spite of lenses. The patient rather likes concave 50 D.C. axis 180° when motoring, for right eye, and concave 1 D. S. with concave 75 D. C. axis 180° for O. S., as his eyes feel better with such a combination; yet often he wears no lenses at all.

The visual field contraction gradually ceased, so far as the left eye was concerned, but there has remained up to date a "break" in ordinary type. In other words, as he reads a long word with the left eye alone, closing the right, three letters ahead are clear and on the level, as set, but the fourth letter and the fifth keep on running ahead out of sight by being lifted up like a caterpillar as the patient mentions repeatedly. With both eyes open this is not noticed. For a long time the patient exercised the left eye alone hoping to obtain by exercise or practice a cessation of the "break" in reading type with the left eye alone, and utilized convex 2 D. S. with convex 75

D. C. axis 90° as most suitable but without avail. After a year of daily practice he gave it up as impossible to obtain perfect sight with the left eye.

To go back to the treatment of the case, the patient was kept abed to quiet his nerves and to diminish his hysteria, which for several weeks was very considerable but which finally ceased. The myotics were continued until it seemed hardly worth while to use them longer. Galvanism was used freely to the eyelid as it seemed to improve the œdema and to improve the paralysis. Hypodermatic strychnia was given and good food; and finally exercise with glasses so that after a long series of experiments the final result was: Vision, O. D. normal and Snellen diamond without lenses. O. S. vision without lenses $\frac{20}{80}$ hardly much improvement with concave spherical 75 with concave cylinder 50 axis 180° and for reading occasionally for practice Snellen 12 with + 75 D. S. ⌣⌢ 50 D. C. 90°. Binocular vision perfect, no diplopia.

Much might be said from a literary point of view of instant death, unilateral blindness, total blindness, evulsion of the eyeball, extrusion of the eyes, divergent strabismus, paralysis of the facial nerve, Argyll-Robertson pupils, choroidal rupture, detachment of the retina, hole at the macula, choked disk, optic atrophy, loss of smell, and other symptoms mentioned in former papers bearing upon the topic of injuries from projectiles. All of these will, however, probably be detailed in books already underway for publication. Each case must invariably stand on its own merits, and will be dependent largely upon the caliber of the bullet, and the precise point of entrance. The ultimate excellent result in the present case is undoubtedly due to the small-caliber bullet, and the light charge behind it. It was a most fortunate result from every point of view, and taught the patient a lesson which he is not likely ever to forget.

The two points of interest here presented are: the ocular paralysis, and the exudates, larger in the eye nearer the point of entrance of the projectile, and diminishing in extent and density after a series of years.

It might be asked, in such cases, if the bullet once located, should be removed and the reasonable answer would seem to be to let it alone so long as it does no harm. To this idea I have adhered, and after some years nothing has been heard from the missile in any way. It might be worth while to make at this late date, a fresh X-ray picture, but the patient would probably resent the suggestion, having had enough of his rashness to last for life.

EXTIRPATION OF THE LACRIMAL GLAND FOR THE RELIEF OF EPIPHORA.[1]

By Dr. CHRISTIAN R. HOLMES, Cincinnati, O.

WHEN your Chairman was kind enough to invite me to attend your meeting this evening and participate in the discussion of the problems connected with lacrimal obstruction, and the method of relieving the tearing which unfortunately continues in so many of the cases, he also asked that I relate my experience in removing the lacrimal gland,—I replied that on account of my duties at Camp Sherman as Chief of the Section of Head Surgery and as my private hospital-residence and library had been closed for almost two years, I had not the facilities nor the time to prepare a paper bringing the subject up to date, but that I would gladly give my past experience.

If you agree, that the result of an operation when demonstrated years after it was performed is of greater value than those reported soon after the operation, then these cases ought to prove the value of the extirpation of the lacrimal gland,—indeed it seems almost ancient history, when you consider that I made the first operation in 1890—more than twenty-eight years ago; and I still see some of the first cases now and then and all have remained cured.

It pleases me that Dr. Arnold Knapp is present this evening for it was his distinguished father who, many years ago, when going to attend a meeting in Chicago, came to Cincinnati to see some of the cases I had operated upon. In 1899 I published an article in the Archives on the extirpation of the lacrimal sac and gland. So far as I know, none of my confrères adopted the operation, although judging by the number of letters I received it created widespread interest.

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[1] Read by invitation at meeting of the Section on Ophthalmology, New York Academy of Medicine, April 21, 1919.

From De Wecker in Paris, I received a four-page, closely written letter, arguing against the removal of the large gland, and asking that I try out his method of only removing the small or accessory glands;—which I did with very imperfect results, and so reported to him. In presenting the subject to you this evening I shall read extracts from the above mentioned article—omitting where possible everything pertaining to the lacrimal sac and confining my remarks entirely to the gland.

The extirpation of the lacrimal gland when diseased dates back to the early days of surgery, and the removal of the healthy gland was advised but not practiced by Paul Bernard for the relief of tearing, where the canal was hopelessly obliterated.

H. Haynes Walton, Surgeon to the Central London Ophthalmic Hospital, wrote in 1835: "Extirpation of a healthy lacrimal gland may be required when the natural channels that convey away the tears are lost."

Lawrence advocated and practiced the extirpation of the lacrimal gland in 1867.

Darrier, in *Gaz. med. de Paris*, 1886, recommends extirpation of the accessory lacrimal gland in cases in which epiphora cannot be checked, or in which the permeability of the sac cannot be restored.

De Wecker, in 1889, reported the extirpation of the palpebral gland in twenty-five cases.

Truc, in *Arch. d'opht.*, xiii., 1893, writes on cases of extirpation of the accessory or palpebral lacrimal gland in simple and obstinate lacrimation.

Terson, *Arch. d'opht.*, xiii., 1893. On the extirpation of the palpebral lacrimal gland.

Terson, *Arch. d'opht.*, xvii., 1898. Comparison between different cases of extirpation of the palpebral lacrimal gland.

Fuchs, in his edition (1898), speaks of the extirpation or destruction by caustics of the lacrimal sac, but refers only casually to the removal of the gland after stating that the moisture of the globe does not entirely depend upon the lacrimal gland, but that the conjunctival as well as the Krause-

Waldeyer mucous glands participate in keeping the eyeball moist.

H. D. Noyes. Under the heading of "Tear Gland" he states: "The gland may be the seat of neoplasms, such as sarcoma and other tumors, and of cystoid degeneration, and is liable to chronic hypertrophy; but these conditions need no special consideration. Its extirpation to cure epiphora was practised by Lawrence, but is not now approved."

From the foregoing we observe that the removal of the lacrimal gland while attempted by a few operators was entirely abandoned. The operations upon the gland reported by De Wecker and Terson were limited to that irregular aggregation of small nodules of gland tissue found under the upper lid, very variable in size, and called the secondary gland, which (or as much of it as can be found) can be removed under cocaine anæsthesia; the patient being directed to roll the eye downward and inward, when eversion of the upper lid will in some, but not all cases, bring into prominence the palpebral portion of the gland, which appears as a small irregular swelling. To me it appears more rational to remove the gland, which supplies at least 90 per cent. of the tears, leaving, if desired, the secondary gland to furnish a small quantity of fluid to dilute the mucous secretion, although even this is not necessary for the comfort of the eye.

The reason for abandoning the removal of the orbital gland can no doubt be attributed to failures, and one can readily understand how, before the days of aseptic surgery, there was much danger accompanying an operation which freely invades the tissues of the orbital cavity; for if an inflammation should develop in such a wound as is produced by the extirpation of the gland, it would be very likely to lead to orbital cellulitis, with strangulation of the optic nerve and vessels, and loss of vision if not of the globe.

I believe that we may safely state that, with strict attention to asepsis, the dangers from infection can now be entirely eliminated, and the results, both immediate and remote, are so highly satisfactory that I can see no reason why the operation should not be resorted to in all suitable cases. (I wrote this twenty years ago—to-day one can't conceive of an infection taking place at the hands of a reputable surgeon.)

An operation which only obliterates the canal without cutting off the annoying supply of tears which torments the patient for the rest of his life, is to my mind a very incomplete piece of surgery.

Extirpation of the Lacrimal Gland.—I formerly shaved two thirds of the eyebrow, and drew down the skin, so that while the incision was made along the margin of the orbit, the skin when allowed to recede brought the cut along the center of the eyebrow. The wound, however, leaves only a delicate scar, which soon fades entirely; while the eyebrows are of such slow growth that now I do not shave the brow, but make my incision below, along the margin of the orbit cutting against the bone, the incision beginning near the center of the upper orbital arch, and, following the bony margin, is carried to a point about 3*mm* below the outer canthus; it will be seen from the figure where the course of the arteries and veins are outlined after Merkel, that we escape nearly all blood-vessels by following this line, so that hemorrhage, as a rule, is very slight. The fascia or septum orbitale is cut through along its attachment to the orbital margin. It is at this point that confusion is likely to arise for the beginner. In the living, the resemblance between the orbital fat and the gland is sufficient to cause confusion, especially if the field of operation is slightly obscured by hemorrhage. The normal color of the gland which authors speak of as rose-red, I have not encountered; those which I have seen were of a delicate pinkish yellow, especially by electric light. This wedge-shaped mass of fatty tissue, a prolongation of the orbital fat, and varying in size in different individuals and according to age, comes down from under the edge of the orbit. Should the fatty tissue be present in the wound, it can be held to one side with retractors. Bleeding points from the edges of the wound must be controlled so as to leave a perfectly clear field for operation. The relation of the anterior edge of the gland to the bony margin of orbit varies slightly; in some the gland presents one to two millimeters below, but the most frequent position is two to three millimeters upward and backward from the edge of the bony orbit. There is a thin but distinct layer of fascia between the superior and inferior gland, which hides the latter from view. Care should be exercised not to displace the orbital contents unnecessarily. The gland tissue is quite friable, and in order to be positive that nothing is left behind to invalidate the success of the operation, much care must be used in dissecting it out in its entirety. This is difficult at the edge most deeply imbedded in the orbit, where the gland is very intimately connected with the orbital fat and connective tissue. The ducts upon the under surface of the gland also offer some resistance. By means of a slender, blunt-pointed pair of scissors, broad fixation forceps, small knife, and a pair of tenotomy hooks, one can with some patience dissect out the gland with but little change of its shape, thereby assuring the operator that the extirpation is complete.

If, in addition, we desire to remove a portion or all of the palpebral or secondary gland, a blunt instrument is passed through the palpebral fissure and the conjunctiva over the seat of the gland pushed by the assistant up into the wound, where the small nodular gland-masses mentioned above can be dissected out. One should avoid perforating the ocular conjunctiva, thereby lessening the danger of infection from the tear-sac wound. I have never encountered severe hemorrhage, but that such may occur with total loss of the eye has been reported by Dr. H. Gifford, in the *American Journal of Ophthalmology*, 1889. I do not close the wound until all hemorrhage (excepting a slight venous oozing) has ceased. The wound is closed by two deep and three or four fine superficial silk sutures, covered with sterilized gauze and cotton, and pad fixed with stripe of isinglass plaster. Both wounds, *i.e.*, the sac and gland, are then covered by a large pad of gauze and cotton, held in position by a roller bandage; unless there has been extensive suppuration of the tear sac with necrosis of bone, the dressing is not disturbed for three or four days, when some or all of the stitches are removed, depending upon the condition found.

CASE I.—Until 1890 I followed in the footsteps of my teachers and never dreamed of removing the lacrimal gland, fearing serious results to the eye, but in that year C. G. T., age 17, with congenital dislocation of both tear glands presented herself in my consulting room with the following history: Had always noticed fullness of skin over seat of glands. At the age of thirteen years, when menstruation began, the fullness over the glands became more marked, associated with varicosity of vessels. The skin over the swelling was much thinner than normal; the tumor was soft, with tendency to bag; lying loosely within it one could feel the gland, which was of normal size; the lower half of it could readily be grasped between the fingers, and slight pressure caused it to slip from between the fingers and disappear under the roof of orbit. When the patient was excited, or when exercising, dancing, or at the time of her menstruation, the swelling would become so engorged as to almost resemble a nævus, disfiguring her and causing comment. Tear sac and eyes normal. No abnormal lacrimation, but patient demanded an operation which would relieve her of the annoying symptoms described. I refused, fearing a dry eye—but she returned and insisted on an operation stating she would take her chances of a good result. The absence of any ill effect upon the eyes after the operation made me determine to remove the lacrimal gland in all cases where the canal was obstructed or the sac removed in order to cure the annoying epiphora. I proceeded to study the best methods, by operating on a number of cadavers; the drawings in my first article (these ARCHIVES, 1899) are from fresh dissections upon a subject secured three hours after death.

Operation. Oct. 23, 1890. Ether anæsthesia. Removed the right gland and excised a portion of the redundant skin. There was very free hemorrhage from the superficial vessels. Closed wound with eight sutures. Dressing and stitches removed on third day. Primary union. December 9, 1890. The left eye was operated upon in the same manner as the right. Result perfect.

Cases of Extirpation of Both the Lacrimal Sac and Gland.

CASE 2.—*History.* John Seyler. Age nineteen.

Operation. Dec. 12, 1891. Chloroform anæsthesia. The right tear sac and gland were extirpated. No fever. Dressing removed on the third day. Union by first intention. The result was so satisfactory to the patient that he asked to have the left side operated, which I did Feb. 21, 1892, with the same result as on the right.

CASE 3.—*History.* T. N. Age forty-seven. Has suffered for years from purulent dacryocystitis and annoying epiphora, much aggravated by a severe form of chronic conjunctivitis secondary to the tear-sac infection. Exposure to wind, or light, as well as close application, caused free lacrimation as well as difficulty in using the eyes. The primary cause of the tear-sac trouble was a severe infection of the naso-pharynx with extensive destruction of the septum and soft palate; periostitis had completely obstructed the bony portion of the lacrimal canal, so that treatment by probing was out of the question. Patient when seen was suffering from chronic sepsis; continuous fever ranging from 99° to 101° F. which I attributed to hidden bone necrosis, probably involving one or more of the accessory cavities, a surmise which afterwards proved correct, when I opened the sphenoid cavity and removed a large mass of dead bone from the anterior portion of the body of the sphenoid, this being followed by permanent cessation of the fever, which had lasted for over one year, and had been attributed to various causes, but chiefly "chronic malaria."

Operation.—April 23, 1892. Ether narcosis. Total extirpation of both lacrimal sacs. The operation did not cause any elevation of temperature above that from which he was suffering by reason of the chronic sepsis mentioned above. Union by first intention. Stitches removed on the fourth day. Pus having ceased to enter the eye, the chronic conjunctivitis yielded readily to treatment, but the lacrimation continued very troublesome, until on May 3, 1894, I removed both lacrimal glands. Stitches removed on the fourth day. Primary union.

I mention this case more in detail because the patient is a very prominent and learned man, for many years in the service of the Government, who suffered so severely from nasal necrosis, that I did not care to run the risk of infecting the tear-gland wound by operating on both sac and gland at the same time, as I have done in all the other cases—but always extirpate the sac first, seal it, and disinfect the face, especially the region of the orbit; operators and assistants and instruments must also be resterilized.

Case 4.—L. K. Age nine. April 11, 1895, I removed both lacrimal sac and gland on the left side. Healed by primary union.

Case 5.—Mrs. M. McG. Age fifty-four.

Operation.—March 10, 1896. Ether narcosis. Removed lacrimal sac and gland. Primary union of both wounds.

Case 6.—Miss M. Age twenty-nine. The sac and gland both extirpated. Primary union. Stitches removed on the fourth day.

Case 7.—*Status Præsens.* H. P. Age five. Child rachitic; teeth black and broken down; chronic purulent dacryocystitis with fistula of sac, left side; complete adhesion of soft palate to posterior wall of pharynx; double media purulenta, with total destruction of membrana tympani, and necrosis of ossicles in the right ear.

Operation.—February 19, 1897. Chloroform narcosis. Sac and gland extirpated. Primary union of both wounds. Notwithstanding his debilitated condition, suffering from severe nasal catarrh, double purulent otitis media, and having three distinct operations, to wit: tear sac, gland, and extraction of ossicles from middle ear, his temperature did not go above normal.

Case 8.—*History.* C. K. Age thirty-five.

Operation.—April 2, 1898. Chloroform anæsthesia. Gland and sac removed. The latter much thickened. Healing by primary union.

Case 9.—*History.* Mrs. M. Age forty-four.

Operation.—February 19, 1898. Chloroform narcosis. Removed the gland and the undestroyed upper part of the sac. Primary union of both wounds.

In the cases so far operated upon, I had only removed the large gland or orbital, but not the inferior or palpebral glands. Their complete extirpation is not always an easy proceeding, as in many cases the palpebral gland is nothing more than a varying number of minute round glands scattered irregularly in the tissue of the upper lid, and often very difficult to find. In this case, after removing the upper gland, which was unusually large, I searched for and removed as many of the nodules of the secondary gland as I could find, thus making as nearly as possible a complete extirpation; my reason for doing this being that in one of the other cases (No. 2), the secretion from the inferior or palpebral gland is, when the eye is irritated, sufficient to cause some annoyance, and as in this case the upper gland was unusually large and lacrimation very profuse, I feared that if left the secondary gland would secrete enough tears to become annoying.

Case 10.—*History.* Prof. D. Age forty-eight. Patient gives history of suffering from affection of the left tear sac since he was one year of age. During all that time the tear sac has passed through numerous attacks of inflammation from slight to the most violent, resulting in perforation and a permanent fistulous opening. Passed through various treatments at different times, till he finally became discouraged, and of late years had left it alone.

On Nov. 22, 1897, he consulted me and asked for the radical cure.

Operation.—March 23, 1898. Mixed anæsthesia. Extirpation of gland, but the sac was so diseased that it could only be made out in part. The skin over the sac was so friable and puckered by repeated inflammations that it became necessary to excise a portion of it. Through the excessive curetting necessary to bring away all of the diseased tissue, the lower lid became detached from its insertion at the inner angle and sagged away from the globe. Replaced by sutures; primary union, even over the sac, without any recurrent manifestations later on. I only mention this case as a type of several others, to show that it is perfectly safe to remove the gland at the same time that you clean up a badly diseased sac—if you use the proper precaution.

Résumé of Cases.—Brought up to May 15, 1898. Reports of surgical cases may, at the time of the operation and immediately after, appear very satisfactory, and yet the good result be transitory, time being the only valuable test. I therefore reëxamined all the cases, and have placed them below in the order they were operated upon.

CASE 1.—C. T. Double extirpation of dislocated glands in 1890. In response to my letter of inquiry, the following reply was received, which I take the liberty of quoting verbatim, as it expresses her feelings upon the subject uninfluenced by the doctor's opinions:

"CARTHAGE, KY., April 4, 1898.

"MY DEAR DOCTOR:

"Your letter came this morning. In return will say that the operation was a perfect success. My eyes are entirely well. They have never given me the slightest trouble since the operation, and I am very grateful to you. Will be in Cincinnati very soon, and will certainly call at your office.

"Yours very truly,
"C. G. T."

CASE 2.—Extirpation of both sacs and glands, 1891–92. Reëxamined April, 1898. Excepting upon careful examination, one fails to see line of incision. Eyes have never caused him any annoyance since the operation. Cannot weep, and only upon marked irritation is there slight amount of lacrimal secretion perceptible. Vision normal.

Case 3.—Extirpation of both sacs in 1892, and of both glands in 1894. This is the only one of the cases where the operation has not given complete relief from tearing. Under strong irritation to the eyes, tears can accumulate in sufficient quantity to be annoying.

Case 4. L. K. Extirpation of lacrimal sac and gland in 1895. Reëxamined April, 1898. The right tear sac, a fistula of which was closed by skin flap, has remained normal. The left eye has been normal since the operation. Vision unchanged. When crying, the left eye becomes slightly moist, but there is no overflow of tears.

Case 5.—Lost from observation.

Case 6.—Reëxamined April, 1898. Eye has been normal since she was discharged. Entirely free from epiphora; only strong irritation causes a perceptible moisture of the globe. Vision of operated eye normal.

Case 7.—Reëxamined February 19, 1898. Eye normal since operation.

Cases 8, 9, and 10 are of special interest, because from Nos. 8 and 10 I removed, in addition to the large gland, some of the nodules making up the palpebral portion, and from No. 9, I removed all.

In the cases where both the orbital and the palpebral glands were removed, the eyes were carefully reëxamined after the operation, in order to see what changes, if any, had taken place, with the object in view of determining if, in addition to the removal of the superior gland, the removal of all, or even a portion of the secondary or palpebral gland, would still leave the eye sufficiently lubricated from the secretions of the mucous glands. In Case 9, on the sixth day after the operation, when my assistant was testing the patient, he found that the vision, which before the operation had been $\frac{20}{20}$, was only $\frac{20}{40}$. A careful examination of the eye revealed nothing abnormal excepting that one could detect a slight amount of mucus upon the cornea. He therefore flushed the eye with a normal salt solution, and found vision at once restored to $\frac{20}{20}$. It was very evident that while the eye received enough lubricating fluid to make it feel comfortable, there was an insufficiency of the watery solution to keep the mucus from adhering to the corneal surface. She was examined from time to time and in two weeks the moisture had again become sufficient to keep the cornea clear of mucus, and vision was normal. This patient reported on June 1, 1898, by letter:

"LYONS FALLS, N. Y., June 1, 1898.

"My eye is a perfect success. . . . In behalf of suffering humanity surely the least I can do is to tell them to weep no more, but to obtain absolute relief by a radical operation."

CASE 10 gave the same result as above, but the return of sufficient moisture to keep the cornea free from mucus was much more rapid than in the former case; and examination of the eye on May 26, 1898, found it normal.

In the preparation of this paper I dissected fifty anatomical specimens cut so as to demonstrate the accessory cavities, lacrimal canal, and turbinated bodies (preserved in Wickersheimer's solution or alcohol).

I give the average measurements from all these specimens, showing the relation of the outlet of the nasal duct to the lower edge of the inferior turbinated, the floor of the nose, and the entrance to the nares as follows:

Outlet from floor of nose: greatest 22*mm*, least 9*mm;* average 16*mm*.

Distance from labeo-nasal junction: greatest 34*mm*, least 25*mm;* average 30*mm*.

Distance of outlet above lower edge of inferior turbinated: greatest 14*mm*, least 3*mm*; average 10*mm*.

It is about 15*mm* less in the denuded skull.

In the hardened specimen, the outlet of canal is round or oval, but in fresh sections nearly always slit-like, so fine that it is often difficult to find it by direct examination of a fresh specimen, especially if the mucous membrane is swollen. The canal may also open at the highest point under the inferior turbinated, or, as it frequently does, pass obliquely through the mucous membrane and come out from 1 to 10*mm* farther down.

Of the glands extirpated, the largest was from No. 9, length 30*mm*, width 13*mm*, greatest thickness 8*mm*, weight 1.3 *g*. In all cases of removal of gland there was primary union.

CRITICAL REMARKS ON THE RADICAL TREATMENT OF EPIPHORA.[1]

By Dr. A. WIENER, New York.

THAT the treatment of epiphora remains a problem for solution is evident from the ever new remedies offered for its relief. That this should be a difficult problem to solve, is well imaginable, when one considers for a moment the complicated physiological mechanism at play, for the furtherance of the tears from the conjunctiva into the nose. When this is disturbed the etiological factors which are responsible are many and varied. Often the failure to relieve a simple case is due to our negligence and carelessness in not considering some of the minor factors. The duct is surrounded by treacherous neighbors. I refer to the nose and its sinuses, which in the majority of the cases, are the cause of some of our worst types of epiphora. It is an established fact, that more than one third of the cases of ulcus serpens are due to diseases of the sac, indirectly produced by an obstruction of the tear duct. It is our duty, therefore, that this fact alone, outside of the great discomfort occasioned by epiphora, be taken seriously, and every effort made to devise ways and means which will remedy this fault.

When one glances over the descriptions of the various operative measures offered for the relief of epiphora, one becomes bewildered over the array of suggestions offered. As far back as the Ancients, among them, Galen and Celsus, there was prevalent the idea, and even carried out, that a direct communication between the nose and the sac could be practiced for the relief of epiphora. In later years Langier and Folz suggested that instead of making an opening into the nose to enter the antrum. In 1904 Toti suggested an operation which on account of simplicity appealed to many. Under general anæsthesia he exposed the sac and the lacrimal fossa. From this fossa he resected an oval piece of bone extending from the post-lacrimal crest downwards as far as the lacrimal duct, and upwards as far as the highest point of the sac. He then removed the inner wall of the sac and the nasal mucous membrane corresponding to the opening in the bone. Light tampons were made throughout the wound and nose, and the skin over this sutured. At times a complete resection of the middle turbinated bone or its anterior end was practiced. In spite of the fact that this method offered much, many surgeons still clung to conservative measures. Hess advised permanent sounds; Koster permanent drainage by means of a silk suture moistened with nitrate of silver; Tartuferi a slitting of the upper canaliculus and internal palpebral ligament, curettage of the sac and its treatment with sounds and antiseptic solutions.

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[1] Read at meeting of the Section on Ophthalmology, New York Academy of Medicine, April 21, 1919.

The intranasal operation, with sacrifice of tissue and probing, recommended by Polyak, Killian, and Passow, but without much practical experience, did not appeal to many. A great disadvantage was its long-continued after-treatment and control. The placing of foreign substances such as decalcified bone tubes (Guital), after opening the sac and curettage, was not successful. The sac prothesis (Zimmerman method) was condemned both by Kuhnt and Schirmer, as an unsuitable method for replacing the functions of the sac. As these methods proved one after the other disappointing, we drifted to the approved radical cutaneous method of extirpation of the sac, as taught by Kuhnt, Czermak, and Axenfeld. While this offered a cure for the diseased sac, it possessed some disadvantages. The natural passageway for the tears, etc., had been destroyed. The epiphora which remained, while only slightly evident at times, at other times was excessive, and could not be controlled even by removal of the accessory tear gland. Besides these above-mentioned procedures, practiced for the purpose of curing chronic suppuration of the sac, chronic recurring suppuration of the sac, with or without fistula, obstruction or incurable obliteration of the lacrimal apparatus below the canaliculi, I admit there are many others. It would be vain to attempt an enumeration of them all, in spite of the fact that they may possess more or less merit. I shall confine myself this evening entirely to the recent representative ones.

At present, more than ever, there has been an endeavor to replace the painful probing of the lacrimal passages for epiphora and its complications, either by extirpation of the sac, or the more modern operation dacryorhinocystotomy. It is still claimed by some gentlemen that probing if persisted in will result in a permanent cure. Experience has taught a great many of us, however, that few patients are willing, in spite of the amiable personality and jollying of some of our good friends, to undergo the long-continued and painful discomfort attending such treatment. In nine tenths of the cases, where there is an actual stenosis, such probing is absolutely useless.

Within the past three years my own experience and what I could gain from the experience of others, has led me to believe, that in all the intractable cases, I refer to such where there is an actual stenosis in the duct with its attending complications in the sac, the proper course to pursue is either extirpate the sac or perform the operation of dacryorhinocystotomy. We are all familiar with the classical operation of extirpation of the sac as practiced to-day. When done in a skillful manner, at times, it accomplishes all that is desired under ordinary circumstances. Only too often, however, the operation is unskillfully performed. It is condemned when really the fault lay with the surgeon who neglected to remove the entire sac. While of late I have become an advocate of the operation which I will presently discuss, I still consider extirpation of the sac under certain conditions the preferable operation, viz.: In progressive cases of trachoma with sac complication, in tuberculosis of the sac, in progressive diseases of the nose, and in those cases where it is necessary to give relief in older people and young children, the sac being diseased. Last but not least when a chronic purulent dacryocystitis exists, and a cataract operation is contemplated it is a wise procedure to extirpate the sac beforehand. For the past three years I have been much interested in the operation which establishes an artificial opening into the nose from the tear sac. This operation is known as dacryorhinocystotomy. At the present time there is a choice between two routes, the external of which the Toti operation is the representative one, and the other the intranasal as practiced by Polyak, West, Mosher, and Yankauer. Of the two routes the intranasal is the more difficult one to perform. It requires especial technical skill limited to those who are skillful in nasal surgery. I can claim from my own experience, that it accomplishes not one bit more than the external operation, if the latter is skillfully performed. The advantage of the Toti operation performed with some refinements in the technic, as suggested by myself, is to my mind an ideal operation. One has at all times a clear view of the operative field. This is most important, as it happens not infrequently that an ethmoidal cell will intervene between the sac and the nasal cavity. When this occurs it is dealt with much more satisfactorily extranasally, than when such a cell is encountered in the intranasal operation. There is no danger of entering the orbital cavity or antrum or intracranial cavity as a possible calamity mentioned by intranasal operators. It is one that I can recommend to all ophthalmologists who are familiar with extirpation of the sac. It can be performed under local or general anæsthesia. This modification of the Toti operation I described in Knapp's ARCHIVES, vol. xlvi., No. 3, 1917, and will not weary you with its complete description this evening.

After performing the operation as described gentle probing is kept up for one month two or three times a week. This is accomplished without the slightest pain and is not to be compared with the probing of the duct. It is necessary to watch the opening within the nose and prevent its closure. The cauterization of the granulations which form around the opening in the nose is all that is necessary. My experience during the past three and a half years with this operation has led me to the following conclusions. I will not burden you with details but will simply state the facts.

Among the cases operated upon were chronic dacryocystitis of the mucopurulent type, ectasia of the sac, and recurrent phlegmonous inflammation, several with fistula, all with demonstrable stenosis at the neck of the sac or below it. In all the catarrhal symptoms were quickly benefited. The epiphora rapidly disappeared but returned after a longer or shorter interval. This, however, could again be remedied after a short treatment with probes. The majority of the patients seem to be better satisfied with the results from this operation than with any of the other procedures. The only cases in which there had been absolutely no benefit, were those in which there had been extensive slittings of the canaliculi and constant probing. This causes a complete disturbance of the drainage mechanism. Such patients will suffer discomfort of having air and nasal secretion blown back from the nasal passages into the conjunctival sac. In one of my cases where this occurred, the patient went through an attack of acute rhinitis without the slightest evidence of any infection of the sac or conjunctiva. By less vigorous blowing of the nose this fault was held in abeyance. Patients in whom constant probing and extensive slitting of the canaliculi have taken place, will therefore not be the proper cases for selection. The claim made by the opponents of the external operation that the scar made is unsightly and disfiguring is not borne out by facts. I wish most emphatically to contradict this. If the operation is skillfully performed, I claim that the scar after six weeks is scarcely perceptible.

Mosher is correct when he says that the operation of dacryorhinocystotomy like other operations devised to accomplish the same end, faces the danger of a gradual narrowing and final cicatricial closure of the nasal opening. The remedy should be a simple one. It can easily be reopened by slitting intranasally or probing through the canaliculi externally with a minimum amount of discomfort.

Last of all should it prove a complete failure in every respect the sac can always be removed.

Considering carefully the foregoing methods and operations which are practiced for epiphora, instead of practicing dacryorhinocystotomy as a last resort, I would suggest that more surgeons attempt this operation, so that ultimately we might get a better idea of what can be accomplished. We as ophthalmologists see these cases continuously. The ultimate results of an operation like dacryorhinocystotomy may thus be more accurately arrived at. All these cases do well in the beginning.

But what we wish to find out is will they continue to do well. Will it be necessary for them to be kept under continued observation and treatment. My own experience convinces me that the results are satisfactory in so far that the suppuration rapidly disappears, the epiphora is very much diminished, and occasional probing is necessary. The opening in the nose must be watched as it will contract in spite of all that we do. It can easily be enlarged through intranasal manipulation and the patient is again satisfied. The probing which is done occasionally is absolutely painless and is not to be compared with the probing which is done through the duct. Whether the placing of a style will give me still better results I am at present unable to state. There is a possibility that this may eventually be extruded. Even if it does I feel that it can be replaced. I am in full accord with the views expressed by Mosher, when he says that every form of intra-, I will add, extranasal operation is only a temporary success, unless supplemented with probing or the prolonged wearing of a style. The latter when not present carries with it a feeling of helplessness. It goes without saying that the operation which is the simplest and gives the most permanent drainage will be the operation of the future.

I would also like to say that the intranasal manipulations necessary for the external operation can easily be acquired in a short time by most ophthalmologists.

REPORT OF A CASE OF CONJUGATE DEVIATION OF THE EYES WITH ASTEREOGNOSIS.[1]

By Dr. HENRY ALSOP RILEY, New York.

The patient, F. B., Italian, age 33, barber, stated that his present trouble began in December, 1918, with disturbed sensation in the right hand and inability to recognize objects by palpation—no muscular weakness. In March, diplopia appeared due to a drawing of the right eye toward the external canthus of the right eye, followed after a week by drawing of the left eye toward the right. There was some dizziness but no headache. He had a heavy cold in January with some fever.

The past history is not important except that in 1903 the patient fractured the right leg below the knee. The right leg has been somewhat weaker than the left ever since the accident. He has had gonorrhea many times but denies syphilis.

Neurological Examination.—Attitude: head turned to the right in order to bring the eyes to bear on the examiner, Gait: weak and unsteady. Coördination imperfect on both sides. Reflexes: slightly more active on the right side, abdominals were inconstant. The right leg was 2*cm.* smaller on the right side than on the left, also true of the right thigh, attributed to the old injury. Sensory examination: diminution of discriminative types of sensation both superficial and deep, affecting particularly the estimation of the distance separating two points and the ability to recognize objects by palpation—slight diminution of pain and temperature; all these changes were confined to the right side. Cranial nerves not affected except for the oculomotor nerves which showed an extreme degree of conjugate deviation to the right, slight nystagmoid movements, and an anisocoria, the left pupil being larger than the right, slightly irregular, central in position. Systemic examination was negative.

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[1] Patient presented before the Section on Ophthalmology, New York Academy of Medicine, April 21, 1919.

Subsequent course showed a slow but steady improvement in the ocular condition until at the present the eyes can be turned as far as the midline. If the gaze be first fixed on the finger and the head be rotated by the free hand of the examiner, the eyes will pass almost into the left canthi. The sensory disturbance has remained unchanged.

Anatomical Consideration of the Oculogyric Pathways.—The oculogyric fibers arise at least in part in a center located at the caudal extremity of the second frontal convolution, pass to the knee of the internal capsule, cephalad to the pyramidal tract compartment, combining with the fibers destined for the nuclei of the other cranial nerves to form a bundle known as the cortico-nuclear fiber bundle. Other centers have been postulated as giving origin to oculogyric impulses in the parietal and occipital regions and it may be that such auxiliary connections may suffice to explain how the patient was able to move the eyes to a greater extent when the gaze was first fixed than by purely voluntary effort. The fibers enter the crus cerebri mesial to the pyramidal tract and begin the process of dispersion to the nuclei of the cranial nerves immediately upon emerging from under cover of the thalamus. The bundles carrying oculogyric impulses leave in three streams, the hypothalamic bundle for the nuclei of the third and fourth cranial nerves, the collicular bundle, the pes lemniscus superficialis, destined for the nuclei of the third, fourth, and sixth nerve nuclei and the peduncular contingent, the pes lemniscus profundus, destined for the sixth cranial nerve nucleus. As they swing dorsally from their parent tract, these bundles enter the mesial fillet, which lies dorsally and then descending until they reach a point almost directly ventral to their nuclei of destination, they swing sharply dorsally and end about the cells of their nuclei. Connecting the oculomotor nuclei and making possible the conjugated movements of the two eyes is the posterior longitudinal fasciculus in whose dorsal surface are embedded the oculomotor nuclei.

Disturbances in oculomotor innervation may result from lesions located as follows:

1. Cerebral cortex-producing oculo- and cephalogyric disturbance.
2. Internal capsule—affecting all the cortico-nuclear fibers.
3. Hypothalamic region—producing paralysis of vertical gaze.
4. Crural and ponto—crural regions-producing disturbance in lateral gaze.

5. The posterior longitudinal fasciculus—disruption of conjugated movement.

6. The Deitero-oculomotor connection—associated with other equilibratory phenomena and nystagmus.

Lesions may be supranuclear, nuclear, or infranuclear in position:

I. Lesions affecting voluntary motor control.

1. If the lesion is irritative.

(*a*) If the location is supranuclear, the eyes will be drawn away from the side of the lesion.

(*b*) If the lesion is located at the nucleus or below, the eyes will be directed toward the side of the lesion.

2. If the lesion is paralytic.

(*a*) Supranuclear, the eyes will be drawn toward the side of the lesion by the action of the antagonists.

(*b*) Nuclear or intranuclear, the eyes will be directed away from the side of the lesion.

II. Lesions affecting the stabilizing control through an interference with the vestibular oculogyric pathway will produce an involvement of the eye movements on that side with nystagmus.

(*a*) If irritative, deviation will be toward the side of the lesion.

(*b*) If paralytic, the opposite.

III. Lesions affecting the posterior longitudinal fasciculus will disrupt the conjugated movements of the eyes through an interruption between the sixth cranial nerve, the pace maker, and the other oculomotor nuclei.

The character of the sensory disturbance indicates a lesion near the thalamus on account of the profound discriminative disturbance, associated with almost negligible affective disturbance, for it has been shown that the collecting together of fibers conducting similar types of sensation begins as we approach the thalamus, thus separating discriminative and affective types of sensation.

The practical application of these anatomical considerations will supply us with data sufficient to localize our lesion at one point in the cerebrospinal axis. The sensory changes indicate a lesion on the left side of the brain high up in the brain stem. Since the site of the lesion is on the left side and the deviation of the eyes is toward the right, there must be an irritative supranuclear lesion of the oculogyric pathway. The third factor is the dilatation of the left pupil. In the midbrain lies the nucleus of the third cranial nerve with its emergent fibers sweeping ventrally through and around the red nucleus and passing through the mesial extremity of the mesial fillet where are located, at this level, largely the fibers carrying impulses of a discriminative character, the fibers carrying affective types of sensation being located more laterally. In this part of the fillet can also be found the caudally directed aberrant pyramidal fibers, the pes lemniscus superficialis, destined for the sixth cranial nerve nucleus of the right side. Here at this point of crossing of the three clinical factors of our case can we locate the site of our lesion.

The serological examination was negative in large part, the Wassermann reaction in both blood and spinal fluid was negative. The spinal fluid contained three lymphocytes, the globulin reaction was three plus and the colloidal gold curve was as follows: 1122100000. These findings would indicate an inflammatory or hemorrhagic lesion, non-luetic in character. Such lesions have characterized the post-mortem findings made in cases of epidemic encephalitis and it seems justifiable to make the clinical diagnosis of epidemic encephalitis affecting the midbrain on the left side.

FURTHER REPORT ON FOCAL INFECTIONS OF THE EYE FROM THE INTESTINAL TRACT.[1]

By J. G. DWYER, M.D., Ph.D., New York.

IN making a further report on the above, the original of which appeared last year, we wish to give in more detail the character of the work and the bases upon which we build the hypotheses.

In the first place, we wish to give at length the probable relationship between the intestinal tract, the teeth, and the tonsils as foci of infection in the eye.

Every ophthalmologist is familiar with pathological conditions of the eye, which he feels have their origin in the intestinal tract, due to what is roughly known as auto-intoxication. No further effort has been made in the past to trace out the relationship, and no effort of a specific nature has been made to overcome the focus, as we have done in the infections from the teeth and tonsils, other than general attention to diet and catharsis, and everybody will agree, we think, on our lack of detailed knowledge regarding the action of foods and their exact changes in the body. Hence the question of focal infections from the intestinal tract has been approached in a totally different way, and after four years of investigation, we are ready to indicate certain eye conditions that we think can fairly be attributed to focal infections from the teeth, tonsils, or intestinal tract, and also a method of treatment of the intestinal tract.

In the first place, we wish to refer the reader to the modern conceptions of the method of action of bacteria in the body—

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[1] Read before Section on Ophthalmology, New York Academy of Medicine, May 20, 1919.

conceptions totally different from our old ones. This paper is too short to deal with the question in any detail, but suffice it to say that we have in the intestinal tract, an ideal source for the production of toxins, or toxic products, their absorption and localization in the point of selection. One very important point to be emphasized and remembered is the fact, that focal infections generally occur only in those parts of the body where we have a change in the blood or lymphatic supply. By this we mean that the parts of the body where the nutritive supply changes rather suddenly from blood to lymph are usually attacked, and in the eye, the part attacked is usually the choroidal coat, etc., where we have a similar change in the vascular supply. It is noteworthy that we hardly ever have infections of this type in the bodies of organs or muscles, etc.

Another very important point is the fact that pressure is of great importance in the production of such infections. An apical abscess of a tooth with pus under pressure is usually of more importance than extensive pyorrhea, and a hard fibrous tonsil with pus under pressure follows the same law. The same general rule applies to the intestinal tract.

Now with regard to the intestinal contents, the main points to be noted here are: (1) the reaction; (2) the food detritus; (3) the relative number of putrefactive bacteria to the colon bacillus.

(1) The reaction—This is a very important point, and one that cannot be emphasized too much. The big majority of feces are excessively acid, and we believe this excess of acidity is of great importance. A certain type is excessively alkaline. This excess of acidity and alkalinity will usually be found to be due to the action of putrefactive bacteria, and one of the main factors in the treatment is to overcome this excess acidity or excess alkalinity as the case may be by the measures outlined under methods of treatment.

By changing the environment in which such putrefactive organisms live and thrive, and making the environment unsuitable we can usually kill off readily the putrefactive bacteria. This reaction is readily altered from excessive acidity by the use of sodium carbonate in solutions as high as 4% but usually for routine purposes we use 1% solutions. Formerly we tried to overcome excess alkalinity by the use of vinegar, but now we try to overcome the bacteria producing this condition, by the use of an excess of alkali, which is non-irritating.

(2) The food detritus—No change has been initiated here and as indicated in our former paper, we aim to establish the diet in such a way that, those types of food which are not assimilated or which are highly protein in nature are cut down. Again, if the carbohydrates are not fully assimilated they also are cut down to the point of tolerance, etc. The amounts of indol and skatol, classed as toxic elements, have been used as the index to measure the degree of toxicity of stools. This method has its disadvantages, but for want of better index we had to use this. These elements are normally present in varying amounts, and it is only when they are present in excess, that they serve as an index probably of too much toxic material.

(3) One of the main points in the work is the examination as to the relative amounts of the colon bacillus compared with the putrefactive organisms. As is well known it has always been a mooted question as to the function of the colon bacillus in the intestinal tract. There are many divided opinions. One school of investigators claim that the colon bacillus is present simply as a saprophyte, performing no function at all; the other school claims that it is an important factor in the digestion of proteins, carrying the digestion of proteins to a further point usually than the indol stage. We accept the latter view, which is quite generally accepted now, and have gone on the plan that after clearing the intestinal contents of the putrefactive bacteria by the sodium carbonate treatment, we increase the amount of colon bacilli by planting in the intestinal tract living culture of a good active strain of colon bacillus.

This, in simple terms, is the basis of the work and the typed forms for the analysis are here appended. The directions for treatment as outlined are also appended. It is very essential that the feces should be obtained as fresh as possible, as the reaction changes very quickly, if allowed to stand, and also the amount of the toxic elements.

The series of eye cases now completed is 122, of which we have complete records. In the beginning we wish to state that a very exhaustive examination of each patient was made, so as to eliminate as far as possible any other cause. The big majority of these cases comprised lesions of the iris and ciliary body—such diseases as iritis, iridocyclitis, cyclitis, "rheumatism" of the eye; keratitis of special forms; retinitis, choroiditis, etc., of the types usually associated with metabolism; optic neuritis of the same type and œdema of the optic nerve; sympathetic ophthalmia.

In analyzing such a series, it is very hard to arrive at a definite conclusion that can be set down on paper, unless we go into a whole recital of separate cases. Our experience goes to show, however, that in this treatment, we have a means of clearing up comparatively quickly such focal infections as are outlined above; that it is a definite advance upon the treatment formerly instituted in such cases, and that it is worthy of an extensive trial by ophthalmologists in such cases. The treatment has in the last two years been applied to kindred focal infections in other parts of the body, and the results are just as striking there. A considerable group of men are now working along different lines and their reports will be published in the near future.

The methods of treatment were originated in large part by Mr. J. J. Connellan, and the fecal examination carried on by him. The clinical investigation was carried on by us. This paper constitutes a report on this phase of the question.

For the last twenty years, it has been the endeavor of various bacteriologists to influence in various ways the contents of the intestinal tract. Reference to the work of such men as Metchnikoff and Escherich show how they worked along these lines. We believe that in the above outlined method, we have a means of definitely changing the condition of the large intestine, and that many pathological conditions having their origin in the intestinal canal are now amenable to direct treatment, compared with the former indirect methods, through the use of cathartics, and the indefinite variations in diet.

DIRECTIONS FOR THE TREATMENT OF HIGHLY ACID STOOLS.

Strict adherence to the diet list. Commence treatment with a small dose of castor-oil or citrate of magnesia one half-hour before breakfast; no further purges. Irrigation of colon: two quarts of warm water, temperature 108° Fahr., containing a teaspoonful of sodium carbonate, to each quart, each night before retiring for three nights. The bag containing the solution should not be elevated over eighteen inches above rectum. Do not use high rectal tube. The small tube about four inches long, generally sold with fountain syringes, answers the purpose. The warmth of solution and slowness of injection permit reverse peristalsis. At the end of the irrigation treatment, three to four tablespoonfuls of sugar of milk is added to the diet for each meal. The live cultures of colon bacilli of approximately six ounces at room temperature are now injected into the colon once every three days, until we have an almost pure culture of colon bacilli in the fecal examination. These cultures are injected extremely slow, either by catheter or rectal tube. Half an hour to one hour previous to plantation of colon bacilli, three to four ounces of a strong solution of common sugar are injected into the colon, the object being to furnish a growing media for the bacilli.

Feces Examination

Color
Brown
Appearance
Odor
Reaction
Concretions
Bile Pigment Tests for Hydrobilirubin
Amylopsin
Trypsin

Toxic Elements
  Indol Plus
  Skatol Plus

Microscopical Examination

Food Residue
  Fibers
  Starch
  Fats
  Other Forms

Pus	
Blood	Tests for Blood Pigment
Epithelium	
Crystals	
Mucus	
Ova	
Parasites	
Bacteria	

TREATMENT OF INTESTINAL INFECTIONS.[1]

By J. J. CONNELLAN, New York.

WHEN calling this method of treatment to Dr. Dwyer's and Dr. McCreery's attention, I had in mind the results of about two hundred odd examinations of fecal matter done for Dr. A. V. Wendel of Newark, during the winter of 1915 and 1916. Dr. Wendel used in his treatment different solutions based upon chlorinated soda with varied success. In Dr. McCreery's case of anæmia, which was about the first one started on carbonate of soda method, the treatment was only suggested after many agents had been tried in their germicidal action with fecal matter, followed by incubation for varying periods and afterwards plating on culture media. The following is a brief outline of the treatment.

The object of the treatment herein described is to rid the large intestine, as far as possible, of the toxin producing organisms present and to replace them with non-toxin producing organisms as the B. coli, which is accepted as being the predominating organism in the large intestines under normal circumstances. This we endeavor to accomplish by introducing into the colon a solution unfavorable to the growth of the abnormal organisms. In the early stages of our work, we found that we had to deal with two types of pathological stools, one of which is characterized by a soft mushy gaseous mass which invariably gave a high acid reaction to phenolphthalein titration, and the other a solid, well-formed stool, such as that found in constipated patients, and which was found to give an alkaline reaction to phenolphthalein. Therefore, we proceeded with the idea that high acid producing bacteria would not thrive in an alkaline environment and vice versa. Hence, we tried a number of different solutions, such as a weak solution of peroxide of hydrogen, lactic acid, acetic acid, chlorine and quinine solution, etc. However, we found that one half to three fourths per cent. solution anhydrous carbonate of soda when added to a fresh fecal specimen, and this specimen incubated for one hour, gave negative culture plates after incubation for twenty-four hours, except in the alkaline specimens. Especially was this true in the cases of stools giving a high acid reaction. We further found that the reaction of the stool is controlled completely by the type of organisms present, and has no relationship with the gastric contents. We therefore accepted the carbonate of soda solution as being one which would give us the effect desired, without causing any undue symptoms or distress to the patient. It is, in addition to being germicidal, very cleansing and non-irritating.

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[1] Read before Section on Ophthalmology, New York Academy of Medicine, May 19, 1919.

The treatment is begun by giving the patient an effective purge fifteen to twenty minutes before breakfast on the day the first cleansing enema is to be given. This purge preferably should be one which produces evacuation by causing increased peristalsis as the result of an irritation, rather than a saline action, for we have found that saline cathartics will alter the character of the reactions.

For these reasons we prefer the administration of castor oil or citrate of magnesia. We suggest the administration of the purge fifteen or twenty minutes before breakfast, as we have observed that a purge given at this time and followed by a slight amount of exercise, produces a rather rapid and complete evacuation of the colon without causing the patient any discomfort from the griping so often complained of by some patients following the taking of a purgative drug. By means of this cathartic, we believe that we are able to almost completely empty the transverse and descending colon, and to empty partially the ascending colon and cæcum. In this way we endeavor to obtain as full a germicidal effect as possible from the initial enema given, by having the colon reasonably free from feces, in order that the patient may receive and retain more readily the two quarts of solution given at each cleansing treatment.

In giving this treatment, we have found that the best results have been obtained by placing the patient in a left Simms position, and adhering to what we have termed a low enema. While we believe that a high enema is more cleansing, when given for that purpose and not with the idea of having the solution retained, we do believe that the manipulations necessary in giving a high enema are too irritating and militate against the objects which we desire to obtain: that is, retention of the carbonate solution, and the absence of irritation, and the production of reverse peristalsis.

Therefore, we have found it most convenient to use the ordinary soft rubber French Catheter No. 16 fixed to the hard rubber attachment of the ordinary douche bag or can. The catheter should be well oiled and introduced five or six inches in the rectum.

In order to produce reverse peristalsis, we believe that the solution used should be warm, at least 108 degrees Fahr., and given very slowly, beginning in the manner of a Murphy Drip and gradually increasing the flow, so that the time required for the introduction of the whole two quarts of solution should consume thirty-five to forty-five minutes. This way, we hope to fully reach every part of the large intestine and distend the mucous membrane enough for the solution to exert its effect upon the whole mucous membrane of the colon, including that part entering into the formation of the rugi of the colon.

The initial enema should not be given for at least two hours after the last evacuation caused by the cathartic, and as it is rather difficult to estimate this time, we believe that it is a safe procedure to place the limit of time for giving the initial enema at twelve-hours after the administration of the cathartic. It is preferable that the enema be given at night before retiring, because at this time the patient will ordinarily be less active and more likely to retain the solution for a longer period of time. We have found that in some cases it has been possible for the solution to be retained overnight. Again the enema should not be given within three hours after a meal, in other words, until long after active peristalsis has subsided following the meal, and at least two hours before a meal, so that the peristalsis produced by food intake will not stimulate a bowel evacuation.

The number of cleansing enemas to be given will depend upon the character of the return flow. That is, the cleansing enemas are to be continued until the return flow is such that it is free from mucus and any offensive odor, and the bacterial sediment in small amount. This will usually require anywhere from five to ten enemas, depending upon the character of the case treated and the experience gained by the treatment of a large number of cases. We have found that it is better to give the second or any succeeding enemas within a twelve-hour period, when it may become necessary, than to allow the patient to go thirty-six hours. For we believe that in the event of waiting thirty-six hours the effect of the soda solution is at a minimum and we are likely to have the production of new crops of bacteria, which might have been eliminated if the enema was given within a twelve-hour period.

The amount of soda given in the solution varies with the character of the case to be treated. In those having a high acid stool, we dissolve two teaspoonsful of anhydrous carbonate of soda to each quart of water used. However, in very high acid stools and alkaline stools, and in those cases complicated by diabetes, we have added four teaspoonsful to each quart of water used. This amount of soda is given in alkaline cases to produce a germicidal effect by over-alkalinization, and in the diabetic cases for the beneficial results which may accrue from the absorption of the soda, and in the very high acid cases for a more pronounced and speedy effect. We have not experienced any bad results from the administration of the soda in the amount mentioned, even after a strong solution has been retained over a long period. We would also advise that in acute toxic cases, such as cases of ptomaine poisoning following ingestion of some product likely to produce such a condition, two or three enemas should be given at twelve-hour intervals at the beginning of the treatment.

We have used as an index in determining whether or not our solution is reaching the cæcum and the amount of absorption of alkali taking place, the examination of the urine as to its alkalinity.

The day following the one on which we have decided that the colon is sufficiently clean and devoid of bacteria likely to inhibit the growth of the B. coli is the day on which we begin to plant live B. coli (B. coli Communis). The number of plants used and the method giving the best results is that suggested by Dr. E. Libman, and is as follows: One plant every day for three days, one every other day for three times, and one every third day for four times. The planting of the B. coli is preceded by a small enema of four ounces of water containing a teaspoonful of milk sugar. This solution should be given very warm fifteen or twenty minutes before the colon plant and allowed to flow into the rectum very slowly. The idea in giving this solution very warm and allowing it to flow very slowly, is to create reverse peristalsis and furnish a suitable pabulum for the B. coli. It is very essential that the same rule relative to time of enemas be applied to planting of the cultures.

We have found that in some cases the administration of the sugar of milk solution is followed by the formation of considerable gas. However, in those cases in which we have had to deal with this condition, we have found that it is very satisfactory to use ordinary cane sugar in the same proportion as milk sugar, for it is a known fact that the B. coli is a non-gas producer with cane sugar.

The B. coli should consist of the washing of two plates with 5% cane sugar solution with sufficient normal saline solution added to bring the amount up to four ounces. It may be necessary to use three plates when the growth is not abundant. We usually added enough of B. coli to four ounces of saline to produce an opaque whitish appearance when held up to the sunlight. This solution is given very slowly after the manner of giving the milk sugar, and fifteen or twenty minutes should be consumed in allowing it to enter the rectum; both solutions when properly administered should reach the cæcum. Both sugar of milk solution and colon plant are given with the intention of having them retained, and it is therefore advisable to keep the patient quiet for a reasonable amount of time after these solutions have been administered.

We have found that B. coli cultures should be used within five hours after washing from plates.

Following Dr. Dwyer's different papers in bringing the method to the attention of the profession, others are conducting investigations in many fields other than the eye. It is now being tried out in heart and kidney cases, blood pressure, different types of skin lesions, orthopedic cases, glycosuria, and diabetic anæmias, and cases that come under the sphere of the neurologist. I feel that I have no right to discuss at the present time results obtained by these men, knowing that their conclusions will be reported shortly.

THE AUTOTOXIC FACTOR IN SYMPATHETIC OPHTHALMIA.[1]

BY DR. ARNOLD KNAPP, NEW YORK.

AN attempt to unravel the mysteries of sympathetic ophthalmia has been made by Elschnig following an idea of Bail by regarding it as an anaphylactic phenomenon. To explain the onset of inflammation in the healthy eye, he has assumed an additional factor in a general disease or autointoxication, and claims that since following out measures directed to relieving this toxic state, no cases of sympathetic ophthalmia have been observed at his clinic. While the anaphylactic theory, though offering many suggestive lines of thought, has been criticized by some especially on clinical grounds and corroborated by others, as in the excellent research work of Alan Woods, the solution of this problem is still far distant in the future, on account of the many difficulties which belong to a most intricate chapter in serology and immunology. It is therefore needless for me to enter into a discussion of these questions on the basis of clinical observation, yet I venture to believe that the publication of four cases concerning the autotoxic factor in sympathetic ophthalmia may be of interest.

Attention has previously been drawn to general disturbance of health in sympathetic ophthalmia, and some have claimed that the constitution of the patient must be regarded. According to Schmidt-Rimpler's theory, in which Panas is of accord, sympathetic ophthalmia can only attack an already sick individual. Elschnig assumes the presence of a somatic anomaly consisting in a constitutional disturbance, nephritis or diabetes, or in auto-intoxication. De Schweinitz, in opening the discussion on the Anaphylactic Basis of Sympathetic Ophthalmia before this Section in 1917, spoke of the late Dr. Hubbell of Buffalo as having in 1900 advocated the relation of auto-intoxication to sympathetic ophthalmia.

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[1] Read at the meeting, American Medical Association, Section on Ophthalmology, Atlantic City, June 10, 1919.

Clinically it has been customary to divide sympathetic ophthalmia into serous and plastic, the latter of much more grave prognosis, while the former yields generally to treatment. Schirmer (*Graefe-Saemisch Handbuch*) speaks of these two forms as grades of the same process; the more fibrinous and the more exudative, the severer the inflammation, and believes that Mauthner is distinctly in error in separating serous iritis from plastic iridocyclitis in sympathetic ophthalmia as being two different processes. In the serous cases, which the French writers call attenuated sympathetic ophthalmia, the pupil dilates under treatment and remains dilated, there are no flat adhesions of the iris to the lens, no papular elevations in the iris tissue and peripheric retraction of the iris does not take place.

In these mild cases interesting fundus changes have been described. Haab (*Heidelberger Congress, 1897*, p. 165) in an article on "Chorioretinitis sympathetica" drew attention to bright disseminated choroidal foci in the periphery of the fundus in conjunction with symptoms of serous cyclitis. These spots are small, round, without marginal pigmentation, often lying under a retinal vessel. There is usually a neuroretinitis. Quite characteristic macular changes develop at a later stage, consisting in a brown spotted base with anastomoses of fine red lines. The macular changes are permanent, though curiously enough they do not affect vision appreciably. The choroidal spots appear from one to five months after the onset of sympathetic ophthalmia and increase gradually in number, and then remain stationary, though Eversbusch has observed their disappearance. The macular changes appear at even a later date.

Prognosis in these serous cases is relatively good, though exceptionally the disease may at any moment go over into the fibrinous form. The serous cases, furthermore, may occur at an unusually late onset, the inflammation in the first eye is not necessarily typical, nor severe, and enucleation does not change the course of the disease.

During the past year I have had the opportunity of observing the four following cases of sympathetic ophthalmia of the type of serous cyclitis which suggested a toxic manifestation.

CASE 1.—*H. S.*, aged 9½, was seen Dec. 12, 1917, stating that eight weeks before the right eye was injured by being struck with a stone; it was then operated upon and treated. At present the eye is soft, with a depressed scar over the ciliary region down and out, cataract and faulty projection. The left eye sees $\frac{20}{20}$, there are a number of posterior corneal deposits and a few pigment spots on the lens. The eye is white, the interior shows a mild neuroretinitis. In view of the symptoms of a beginning cyclitis in the second eye, the right eye is immediately enucleated. General treatment, consisting of thorough catharsis, attention to diet, subconjunctival injections and atropin are instituted. The deposits in the left eye cleared up and patient was discharged on January 10th. One month later some additional deposits were seen. Treatment was again instituted in the hospital, and after one month the condition had again cleared up and the eye has remained normal.

Microscopic Examination.—There is a gap at the sclerocorneal junction which is filled with loose connective tissue containing dilated vessels and collections of lymphocytes. The root of the iris is transformed into a very vascular and cellular tissue. The cells at this place are lymphocytes, epithelioid cells and giant cells; the last especially in the neighborhood of several foreign bodies. This infiltration continues into the swollen ciliary body and processes and diminishes in intensity in the congested choroid. There is an organized exudate extending from the site of the penetrating injury along the anterior and especially the posterior surfaces of the lens where a beginning detached retina is adherent. The optic nerve shows a moderate neuritis with œdema, swelling and proliferation of septal cells.

CASE 2.—*E. D.*, aged 37, a baker by trade, was seen May 16, 1918, stating that four weeks ago the right eye was injured by the penetration of a piece of steel. This was extracted with a giant magnet, but the eye has never entirely recovered, and for the past four days there has been an increase in the inflammation. Patient is fat and flabby, has always been an excessive sugar eater and has suffered from constipation. To-day marked ciliary congestion, a central wound of the cornea and lens capsule, hypopyon.

Vision $\frac{1/2}{200}$. Admitted to the hospital and treated with leeches, atropin, salicylates, subconjunctival cyanide injections and pilocarpin sweats. Two weeks later the iridocyclitis remained intense and had not in any way responded to treatment. Complained of slight discomfort in the left eye and on examination there was slight ciliary congestion, posterior corneal deposits, and neuroretinitis. S. = $\frac{20}{50}$. The right eye was then enucleated. While under ether a deep cyanide injection was made in the left orbit. He was put on a daily pilocarpin sweat and mercurial inunctions. The pupil responded to atropin; there remained ciliary congestion, many corneal deposits, neuroretinitis.

June 19th.—S. = $\frac{20}{40}$. The eye was slightly better. Examination by the dentist revealed two defective teeth in the upper jaw; these were extracted, without subsequently exerting any particular influence on the eye condition. The patient was very prone to atropin eczema and was put on a sugar-free diet and given dilute nitric acid before meals.

July 1st.—S. $\frac{20}{40}$, slight ciliary congestion, corneal deposits as before. Vitreous slightly cloudy, optic nerve blurred. In the periphery of the eye ground there were many characteristic round choroidal atrophies as described by Haab.

July 23d.—There had been a gradual improvement. Some of the choroidal foci had disappeared and in the macula lutea there was a beginning formation of irregular pigmentation. Vision $\frac{20}{30}$.

July 30th.—Gradual improvement; a few corneal deposits, fundus clearer, pigmentary changes in the macula more marked.

August 7th.—S. $\frac{20}{30}$. The eye has had a slight relapse. This promptly subsided on a thorough evacuation of the bowels. August 14th. $\frac{20}{20}$. Pupil free and reacts. There are about fifteen small posterior deposits. September 20, 1918, vision normal. A few corneal deposits remain. Pigmentary changes in the macula without in any way affecting his vision.

Microscopic Examination.—There is a cellular infiltration in the swollen subconjunctival tissue at the limbus which extends back. In the scar of the periphery of the cornea a knuckle of iris is caught. The posterior surface of the cornea is lined with inflammatory products which are also present on the anterior surface of the iris. The iris and ciliary body are in an active stage of inflammation, the leucocytes being particularly abundant in the pars ciliaris retinæ and the adjoining parts of the vitreous. From there backward the character of the inflammation changes and a typical infiltration of the choroid with lymphocytes can be observed. This infiltration increases and in the posterior part of the eyeball completely fills the choroid. The optic nerve is swollen and inflamed.

Case 3.—*S. B.*, aged 20, a well-nourished young man, was seen September 25, 1918, referred by Dr. Darling of New Rochelle. The right eye was injured November, 1917, by a nail. The eye was at first treated, but an enucleation became necessary on December 6th. The left eye became involved three days later with ciliary congestion and corneal deposits, and vision was very much reduced. The eye improved, but there have been many recurring attacks of severe inflammation and diminution of sight. The last one of these was September 10, 1918, and was very severe. To-day the eye is white, pupil dilated, posterior synechia, many posterior corneal deposits distinctly brownish in color. Iris markings fair, tension normal, vitreous clear. Vision $\frac{20}{40}$. Patient was seen by Dr. W. E. Deeks, of New York, who regarded him as a case of sugar intolerance.

An *examination of the stool* by Dr. J. G. Dwyer of New York, showed a very toxic stool, highly acid reaction, indol, 4 +, skatol 3 +, bacteria all Gram positive. The urine contained a trace of albumin and casts. He was put on a restricted sugar-free diet and given dilute nitric acid before meals and high colon irrigations. He was subjected to the usual treatment by sweats and subconjunctival salt injections. Gradual improvement until Nov. 8th, slight relapse, the eye becoming red for two days, with an increase in the corneal deposits.

Nov. 26th, another relapse with ciliary congestion and a narrowed pupil.

Dec. 6th, another examination was made by Dr. Dwyer of the stool, which was then found improved and only slightly acid.

Dec. 18th, after a stay in the hospital of ten weeks, vision $\frac{20}{80}$-, vitreous clear, retina hazy, choroidal atrophies and a central chorioretinitis. The treatment with the diet was continued, and he was advised to take castor oil once a week. A slight attack on Dec. 25th, which lasted two days. The recent attacks have been distinctly getting very much milder.

March 4th, has had no further attacks. Vision to-day is $\frac{20}{80}$. The lower half of the cornea still presents many brownish but small deposits, tension normal, faint opacities of the vitreous; the fundus changes are quiescent, some macular pigmentation and in the periphery of the eye ground, small choroidal atrophic spots.

It was impossible to obtain the enucleated eye for microscopic examination as the oculist who removed it is at present in France.

CASE 4.—*J. F. L.*, aged 48, a pale, fat man, was seen October 12, 1918. Has had symptoms of glaucoma in the left eye for which in August he had had an iridectomy performed by his oculist. One month later the eye became inflamed and has remained in this condition up to now. Today R. $\frac{20}{30}$, L. $\frac{20}{200}$. There is an irregular scar in the upper part of the left cornea from the iridectomy incision in which iris is caught. Ciliary congestion and posterior corneal deposits. Tension: R. 25, L. 32. He is admitted to the hospital for treatment. Pilocarpin sweats, mercury by mouth, and cyanide subconjunctival injections are given.

Oct. 23d.—The right eye had developed a ciliary congestion and posterior synechia. R. $\frac{20}{70}$, L. $\frac{12}{200}$.

Oct. 25th.—The right eye had responded to treatment and an operation was performed on the left eye in order to free the adherent iris. This was done, causing very little additional traumatism to the eye, but was followed by a recurrence of the cyclitis with exudation in the coloboma.

Oct. 28th.—The right pupil was dilated, tension normal.

Nov. 4th.—The right eye again showed ciliary congestion, with posterior deposits, hazy vitreous and neuroretinitis. S. $\frac{20}{200}$. The left eye was moderately inflamed and the lens showed a beginning cataract. He was now subjected to a thorough general examination which gave a negative Wassermann, streptococcus fixation test negative, urine normal. There was a posterior ethmoiditis on the right side and a probable affection of the gall bladder. He was put on a sugar-free diet with daily sweats, a mercury pill, and colon irrigations.

Nov. 13th.—The gall bladder was found tender on palpation. R. $\frac{1}{200}$. Field for hand apparently normal.

Nov. 22d.—R. $\frac{8}{200}$. Vitreous very dull, apparently an exudate about the optic nerve. Left tension normal.

Dec. 6th.—R. $\frac{1}{200}$, many corneal deposits with deposits on the lens capsule, vitreous cloudy, fundus dull.

Examination of the stool by Dr. Dwyer revealed very toxic acid stool with exclusively Gram positive bacteria, indol 5 +, skatol 3 +.

The sweats were then stopped, colon irrigations and a restricted diet begun.

Dec. 18th.—Somewhat better. S. $\frac{8}{200}$, eye ground clearer. A mixed vaccine was given and B. B. culture.

Jan. 6th.—R. $\frac{12}{200}$, gradual improvement. Blood analysis showed NPN 41, Urea N 17.3, Creatinin 1.10, Uric ac-3.7, Sugar .11.

Jan. 21st.—Many posterior corneal deposits, the interior much clearer, pupil dilated. Left cataract had advanced, perception of light good, the eye quite free from inflammation, and tension normal. A number of affected teeth were removed.

Feb. 6th.—R. $\frac{20}{70}$. Left eye showed secondary glaucoma.

Feb. 13th.—Relapse in the right eye apparently following a fresh head cold. S. $\frac{20}{100}$, fundus hazy.

March 10th.—Re-admitted to the hospital. The cataract in the left eye was extracted to relieve the secondary glaucoma. After this operation an attack of glaucoma developed in the right eye, but gave way to drops.

March 13th.—The right ethmoid cells were cleaned out and this was again followed by an attack of increased tension in the right eye.

April 1st.—The right eye was quiet; pupil semi-dilated, some deposits on the lens capsule at pupillary margin. Posterior corneal deposits. S. $\frac{20}{50}$. Fundus showed peripheric choroidal and macular changes. T. 30. The left eye: secondary cataract, eye white. Projection and tension normal.

Remarks.—In these cases an injury or an operation causing iridocyclitis in one eye was followed by serous iridocyclitis in the second eye. In the first case the symptoms were mild and yielded readily to treatment. In the other three the ocular symptoms were those typical of serous cyclitis, namely, moderate ciliary congestion, dilated pupil, posterior corneal deposits, vitreous opacities associated with fundus changes which have been described under the name of chorioretinitis, sympathica, neuroretinitis, and macular changes. The characteristic small choroidal spots appeared without any pigmentation in the periphery of the eye ground after the process had existed for about six weeks and some of them later disappeared without leaving any trace. In the two more severe cases there were larger irregular chorioretinal foci. Neuroretinitis was present in all. The macular changes consisted in irregular choroidal pigmentation, appearing late in the course of the disease and apparently not affecting vision.

The *anatomic examination* could only be made in two of the three cases where an enucleation was done. The changes in the eye of Case 1 consisted in mononuclear lymphocytic infiltration of the uvea, particularly of the iris and ciliary body, and slight optic neuritis. In Case 2 the evidences of a purulent inflammation preponderated in the iris and ciliary body but the typical sympathetic infiltration was pronounced in the choroid, especially in its posterior half about the inflamed optic nerve. The enucleated eye from Case 3 could not be obtained for examination. In Case 4 the injured eye is now white; there is a secondary cataract, posterior synechia, light projection and tension are normal.

The *autotoxic factor* depended on the following: There was generally a history of improper diet and overeating, often associated with constipation. The examination of the stools was made by Dr. Dwyer in two of the cases and gave a highly toxic acid stool, large excess of skatol and indol and exclusively Gram + bacteria. Treatment which was the usual one practiced in sympathetic ophthalmia, namely, mercurial inunctions, sodium salicylate, pilocarpin sweats, did not seem to have very much effect. It should be also mentioned that the elimination of associated infections, abscessed teeth, and nasal sinus empyema, did not exert any influence of the course of the disease. Regulation of the diet, thorough catharsis and colon irrigations seemed to be our most effective agents.

Objection has been raised against Elschnig's hypothesis of an autotoxic state in sympathetic ophthalmia, at least the demonstration of the symptoms and changes in autotoxemia have been vehemently attacked and dismissed as inadequate.

Treatment in sympathetic ophthalmia usually consists in mercury by inunctions, which is the remedy favored by the German writers, and large doses of sodium salicylate, by which H. Gifford has obtained such brilliant results. It is true that the cases of serous sympathetic iridocyclitis, the attenuated form, usually get well, and it is hard to say how much any treatment helps. At any event, we do not know in what way either mercury or sodium salicylate acts.

I realize the temerity of advocating autotoxemia at the present day, and I am fully conscious of the many imperfections in the presentation of these four cases from an autotoxic standpoint; yet I feel the importance of investigating for a toxic factor in sympathetic ophthalmia, and if found present its elimination in a prophylactic endeavor, as Elschnig suggests, cannot be passed by.

REPORT OF TWO UNUSUAL COMPLICATIONS OF HERPES ZOSTER OPHTHALMICUS: (*a*) ACUTE RETROBULBAR NEURITIS (NEURITIS AXIALIS); (*b*) ACUTE GLAUCOMA.[1]

By CLARENCE A. VEASEY, M.D., Spokane, Wash.

OCULAR complications of herpes zoster ophthalmicus are by no means rare. It is believed by most authorities that they are most frequently observed when the nasal branch is involved. The conditions usually noted are keratitis, anterior uveitis, and at times a more or less extensive iridocyclitis. The notes of the following two cases show some points of unusual interest:

Case 1.—*Acute retrobulbar neuritis (neuritis axialis) complicating an attack of herpes zoster ophthalmicus.* Mrs. J. K. M., aged about forty, married, was first seen by me December 8, 1911, on the third day of an attack of herpes zoster ophthalmicus on the right side for which she was being treated by the family physician. The right eye was somewhat congested and lacrimation was quite free, but there was no ulcer and no visible ophthalmoscopic change. Four days later, or on the seventh day of the attack of herpes, the patient first observed that vision in the right eye was almost entirely abolished, there remaining only a small portion of the upper field. She was an exceedingly intelligent woman and stated that when the vision first began to disappear she observed a dark area directly in the center of the field which gradually became larger and larger until at the time I saw her on the date mentioned there remained only a very small area in the upper portion of the field. No ophthalmoscopic change in the nerve or fundus could be detected. The following day vision was entirely abolished, not even light perception being present. The pupil was small and still no visible ophthalmoscopic change could be observed. There was no corneal involvement at any time and no involvement of the nasal branch of the nerve existed during the attack of herpes.

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[1] Read at the fifty-fifth annual meeting of the American Ophthalmological Society at Atlantic City, N. J., June 14–17, 1919.

The urine revealed a small amount of albumin. The blood showed normal hæmoglobin and the white corpuscles to be but slightly increased. An examination of the nasal accessory sinuses proved negative.

On January 2d of the following year, nearly four weeks from the beginning of the herpes and more than three weeks from the beginning of the neuritis, central vision was still abolished by a large central scotoma, the vision of the peripheral field having improved. A week later the patient could count fingers with this eye at two feet. The optic nerve was now quite pale and distinctly atrophic.

In spite of mercurial inunctions, the iodides, pilocarpin sweats, and subsequent daily strychnia injections into the temple, not only could no further vision be restored but the small amount present became entirely abolished, the eye remaining totally blind, the optic nerve being completely atrophied.

A few weeks later the patient developed an appendicitis and was successfully operated upon. She had always been rheumatic and had had several severe attacks for which she had taken hot baths and mud baths at one of our local resorts. She had also been subject to supra- and infraorbital neuralgia. The attack of herpes zoster ophthalmicus, however, was the first she had ever had, the acute retrobulbar neuritis appearing a few days after the beginning of the attack and passing rapidly to total blindness with complete optic nerve atrophy.

So far as I have been able to ascertain in the search of the literature, the case is unique, as I can find no mention of acute retrobulbar neuritis complicating a case of herpes zoster ophthalmicus.

Acute retrobulbar neuritis has been reported as of septic origin and due to focal infections. Lambert and Hansell, at the meeting of the American Ophthalmological Society in 1918, reported such cases, and in the discussion of their papers, Shumway, Shoemaker of St. Louis, Weeks, Sutphen, and Carpenter referred to additional cases. The above case was observed before we were studying focal infections. It has been shown recently by someone, I believe, that herpes zoster may arise from a focal infection. Whether this was true in the above case and the acute retrobulbar neuritis, as well as the herpes zoster, was due to a focal infection, or whether the neuritis was simply a complication due primarily to the herpes, of course it would be impossible to state.

CASE 2.—*Acute glaucoma complicating an attack of herpes zoster ophthalmicus.* On November 5, 1918, A. B., an unmarried male, aged about thirty, presented himself for diagnosis of the condition of his right eye. The following history was obtained: Three weeks before there had been observed first a number of blisters on the right forehead and on the right temple and side of nose. There was also marked swelling of eyelids. Since then the vision of the eye had been poor.

The vision of O. D. was $\frac{1}{45}$, of O. S. $\frac{6}{5}$. The cornea of O. D. was peppered with minute areas of superficial infiltration, as if there might have been broken down herpetic blisters. The whole cornea was in addition quite hazy; the anterior chamber was apparently of normal depth and the pupil widely dilated and immobile. There was marked pericorneal injection. No fundus examination was possible on account of the haziness and peppered condition of the cornea. The tension by the Schiotz tonometer was 35*mm.*

The patient was a Christian Scientist and had been under the care of a Christian Science reader since the beginning of the attack. He stated that he had no pain, but his facial expression and his worn-out appearance showed that he had suffered severe pain, although, I understand, Christian Scientists do not admit that pain exists.

The typical spots of herpes zoster ophthalmicus in the stage of clearing up were observed. The nasal branch was affected as well as the supraorbital. The patient could give no idea as to the length of time the glaucoma had been present.

He was given a solution of pilocarpin for instillation into the eye, together with a purge and hot compresses, and within three days the tension had become normal. But the vision was still reduced as before, probably because of the corneal condition and the length of time that the tension had been elevated. The patient, during the few days of his appearance at the office, was always under the care of a Christian Science reader, and after these few days' observation disappeared and has not been seen since, so it is not known just what the ultimate outcome was.

This case seems to be one of acute glaucoma complicating the attack of herpes zoster ophthalmicus. Such a condition is comparatively rare. Weeks at the meeting of the American Ophthalmological Society in 1917 reported three cases and reviewed the literature.

As to the etiology, it has been shown that the aqueous humor is changed in all cases of inflammation of the uveal tract. In some there has been found an increase in albumin, and in the aqueous of glaucoma there has been shown to exist both organic and inorganic matter. Weeks states that in a case of glaucoma secondary to a tubercular uveitis, he obtained a decidedly positive test for globulin in the aqueous. Because of the above conditions he concludes that the acute glaucoma is due directly to the changes which have occurred in the aqueous humor and the inability of the lymph spaces at the filtration angle of the anterior chamber to permit of proper filtration because of these changes.

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By Dr. ELLICE M. ALGER, Secretary.

MONDAY EVENING, MARCH 17, 1919. ARNOLD KNAPP, M.D., CHAIRMAN.

Dr. George H. Bell presented a patient with a **deep keratitis occurring after anti-typhoid vaccine,** a condition which has been observed several times in the military service abroad. (This case is fully reported in the preceding issue of these Archives.)

Col. Walter R. Parker said he knew of two similar cases and had seen one probable one himself.

Dr. Henry H. Tyson presented a case of **pituitary struma** recurring after an operation for partial enucleation of the growth two years before.

Patient, male, aged 25 years, had been operated upon by Dr. H. Cushing, Boston, Mass., on March 30, 1917, on account of poor vision in his right eye, with visual fields indicating pressure upon the chiasm. Dr. Cushing made a transfrontal osteoplastic exposure, and partial removal of the pituitary struma, which he described as a soft reddish mass protruding between the legs of the chiasm. He removed a portion about 2 *cm* in diameter, and remarked that it was surprising that the left nerve was not the more damaged of the two, as it was pushed far to the side. Vision previous to operation: O. D. = p. l., O. S. = $\frac{20}{50}$ with bitemporal hemiachromatopsia. Six weeks after the operation: V. O. D. $\frac{20}{30}$, O. S. $\frac{20}{15}$; visual fields practically normal. On October 22, 1918, he reported that about six months previous he had noticed that the vision of his left eye began to fail, with occasional headaches over left eye.

He had been taking pituitary and thyroid extracts alternately for four months; and observed some swelling of his thyroid gland about the same time, which, however, subsided later. V. O. D. $\frac{20}{30}$, O. S. $\frac{20}{50}$. November 12, 1918, Dr. George Dixon, X-rayed his sella, and stated that he would be inclined to regard it as some osseous malformation rather than indicating the presence of a soft tumor. On March 15, 1919, his vision had receded to O. S. $\frac{6}{20}$, O. D. $\frac{20}{500}$ with bitemporal hemiachromatopsia, the nasal field of his left eye being encroached upon by the blind portion to the extent of 5° from the vertical meridian with contraction for all colors in the nasal field also. The interesting features are the return of the pressure symptoms after a lapse of two years, and the fact of the corroboration of Dr. Cushing's observation of two years previous, when he considered the anatomical relations of the two nerves, he was surprised that the left nerve was not the one more affected. The patient is about to visit Dr. Cushing for another operation.

Dr. S. A. Agatston presented a patient with **ophthalmoplegia interna following pneumococcus conjunctivitis** The patient, a nurse, was admitted to Dr. May's service at Bellevue Hospital with a severe conjunctivitis of her left eye. Smears showed the presence of pneumococcus. Complement fixation test for gonorrhea was negative. Three weeks after the onset of the disease, the right pupil became dilated. There was no reaction to accommodation or light, either direct or consensual. Vision was O. D. $\frac{20}{50}$, O. S. $\frac{20}{20}$. Wassermann was negative. Three weeks later, there was no change in the condition. Diagnosis was made of affection of the ciliary ganglion of toxic origin, caused by the conjunctivitis in the other eye. The patient was perfectly well otherwise.

Dr. J. Wolff presented a boy with **paresis of accommodation,** which had cleared up suddenly though only temporarily on several occasions after loss of blood sustained in such various ways as a nasal hemorrhage during a fight, and the abstraction of blood for a Wassermann test. The patient, Charles G., 12 years old, came to me on Dec. 10, 1918, with complaint that he could not read well for the past two weeks. In October, he had had an attack of grippe and on Nov. 27th his tonsils had been removed. No history of diphtheria nor of intestinal or other form of intoxication. Examination showed no organic disease in any part of his eyes. Vision O. D. and O. S. $\frac{15}{20}$ plus, with sph. plus 0.50 D: $\frac{15}{15}$ plus. That is, the accommodative power of his eyes was not sufficient to overcome his slight hypermetropia. He could not read Jg. 1 until sph. plus 1.25 D. was added to his eyes. His range of accommodation was only about 4 D. I prescribed this glass to aid him temporarily.

On December 15th I saw him again and was told that the above condition had remained two days more. He then had a tussle in school with a playmate that cause his nose to bleed. Immediately after this he noticed that his vision was clearer and since then he has been able to read easily without glasses. Tests this day showed his accommodation to be normal.

On January 15th, he was brought to me again with the statement that he had seen well until two weeks ago. While writing in school he suddenly felt "as if something rolled down over the top of his head and he was very dizzy." Immediately he found he could not read well and this condition has remained since. I found his pupils round, equal, reacting well to light but very feebly with accommodation. Accommodative power of each eye only 5.0 D. External muscles, fundi, and fields normal. I thought of a possible brain lesion but could find no other symptoms. Still I suggested that a Wassermann test be made. As soon as the blood was drawn from his arm he again noticed that his vision cleared up and his accommodation improved. He is now able to read Jg. 1 at 8 *cm* from his eyes without glasses.

The interest in the case attaches to the two attacks of weakened accommodation of unknown origin, each of them relieved at once by a moderate loss of blood.

Dr. WOLFF presented a patient with a large **orbital abscess** without any indication of sinus disease. M. S., girl of 10, in October, 1918, had an attack of the prevailing epidemic of influenza with severe headache. Was ill for ten days but since then felt well until near the end of November, when a swelling appeared in the left upper lid which gradually became larger.

When seen by me early in December the upper lid was very red and swollen and the eyeball protruded about 5 *mm*. Motility was somewhat impaired in all directions. The swelling was painful to the touch and a deep fluctuation could be felt.

The diagnosis of orbital abscess at the inner wall was very evident.

Careful and repeated examination of the nose showed no intranasal disease whatever and no trace of discharge. The X-ray picture of the orbit and sinuses was negative.

On December 12th under general anæsthesia a deep subperiosteal abscess was evacuated and drained. The inner bony wall of the orbit was thoroughly exposed and examined, but no trace of a communication with the nose could be found. Healing was uneventful and the globe receded as the swelling disappeared.

The interest in this case is centered in the consideration of the question how the subperiosteal orbital abscess came about, in the absence of any traceable connection with the nose. I incline to the belief that at the time of the headache during her illness there was a deep ethmoidal infection which traveled along venous or lymph channels into the orbit.

Dr. A. GOLDSTEIN showed a very good example of **persistent hyaloid.**

Dr. D. H. WIESNER presented a patient with a **tumor of the macular region** in the left eye, which had been under his observation for several years without notable change. It was a mound-like elevation arising abruptly from the fundus to a height equivalent to 9 diopters, grayish white in color, and with vessels running over it. Vision reduced to fingers. The Wassermann was negative and the cutaneous tuberculin test was negative so far as the skin and temperature were concerned, but there have appeared in the retina a number of small, irregular white spots which were not there before.

Lieut.-Col. GEORGE S. DERBY, of Boston (by invitation) then read the first paper of the evening on **observations on eye work with the British and American Expeditionary forces** (published in March ARCHIVES).

Capt. G. H. GROUT read the second paper of the evening on **experiences in reparative surgery after war injuries of the eyes** (published in March ARCHIVES).

MONDAY EVENING, APRIL 21, 1919. ARNOLD KNAPP, M.D., CHAIRMAN.

Dr. HENRY A. RILEY presented a case of **conjugate deviation to the eyes with hemi-astereognosis** (published in this issue).

DISCUSSION: Dr. WARD A. HOLDEN. We are all indebted to Dr. Riley for his admirable working out of the anatomical lesions underlying the complex and unusual group of symptoms that his patient presents.

As oculists, we see from time to time paralysis of lateral version of the eyes, or paralysis of ocular gyration as the French neurologists call it, but we have been inclined to accept a simpler interpretation. Indeed, since every eye muscle is supposed to have a cortical representation in both cerebral hemispheres, it has been believed that these paralyses are rarely due to a supranuclear lesion. The pontine and principal center of ocular gyration to one side is the abducens nucleus of the same side which, through the posterior longitudinal fascicle, controls the internal rectus of the opposite side. And, apart from the transitory spasmodic conjugate deviations of apoplexy, the great majority of these paralyses are due to a lesion involving the abducens nucleus. Since extension of such a lesion laterally or dorsally would involve the facial nerve trunk and extension ventrally would involve the motor pyramidal tract, we find that many of our patients, if kept under observation long, develop a facial palsy on the side of the paralysis of gyration or a muscular weakness of the body on the opposite side.

Such classical cases we may ourselves interpret, but for the interpretation of unusual cases such as the one presented by Dr. Riley, we must rely upon the superior anatomical attainments of the neurologist.

Dr. E. M. ALGER presented a patient with **sarcoma of the lacrimal gland** removed five years ago and so far without recurrence. The growth had been noted four years before, caused the characteristic displacement of the eyeball, and was easily palpable. There was a central choroidal lesion, vision being reduced to $\frac{20}{200}$ and minimizing any diplopia. Wassermann was negative. The growth was removed under general anæsthesia, through an incision in the outer half of the eyebrow. It was enclosed in a thin capsule which ruptured, but both the gland and its accessory were removed. Healing was uneventful, the displacement of the ball disappearing entirely. The tissue was submitted to Dr. G. S. Dixon who reported that it was a sarcoma of the gland and in his opinion likely to recur.

The case was interesting because pertinent to one of the papers of the evening, because of the long period without recurrence in spite of rupture of the capsule in the operation, and because it illustrates how comfortable an eye can be without any lacrimal gland, the secretion from the various accessory glands being sufficient to keep it moist. This case bears out the contention of several writers that adenosarcoma of this type has a very low malignancy and offers a relatively good prognosis.

Dr. ALGER also presented a woman of 50 with a **sarcoma of the iris in the ciliary body.** It was first noted as a pigmented spot some two years before, and on the advice of an optician was disregarded. The growth apparently sprang from the root of the iris, was about five millimeters in diameter, and projected forward almost to the cornea. The tension of the eye was slightly raised. Half-way between the limbus and the insertion of the internus were several small points of black pigment indicating impending perforation of the sclera. Transillumination showed an opaque mass in this region and the whole ciliary body appeared as a very dark shadow, entirely different from the appearance of the other eye. She had a mass, possibly malignant, in her liver. The question was as to the advisability of removing an eye which was not troublesome in any way and had fair vision, in view of the liver condition.

He proposed, before operating, to have her very thoroughly examined for other evidences of metastatic growths.

DISCUSSION: Dr. C. R. HOLMES, of Cincinnati strongly advised enucleation. He remembered a similar case in which early operation was refused and over 1200 separate metastatic nodules appeared before death. Dr. W. E. LAMBERT and Dr. J. E. WEEKS concurred in the advice, the latter thinking that evisceration of the orbit was indicated if the growth had actually passed outside the sclera. Results even in such cases were not entirely hopeless though even in the uncomplicated ocular sarcomata from 50 to 60% showed recurrence or metastasis under five years.

Dr. E. S. THOMSON showed the stereographic radiograph of an **orbital tumor** in a woman of 48 who came to him in January, 1913, after an extensive operation by Dr. J. A. Bodine for the removal of a growth in the sphenomaxillary fossa. A large mass of tissue was removed involving the floor of the skull. It was supposed to be an osteosarcoma though this was not definitely determined. The present plates showed an extensive bony thickening of the orbit which is filled with a soft mass, most probably sarcomatous. It was evidently inoperable.

Dr. ALFRED WIENER then read a paper on **some critical remarks on the radical treatment of epiphora** (published in this number).

Dr. CHRISTIAN R. HOLMES, of Cincinnati (by invitation), read a paper on **extirpation of the lacrimal gland. Its value in all cases of incurable obstruction, or after removal of the lacrimal sac** (published in this number).

Dr. SIDNEY YANKAUER: The speaker has dwelt upon the fact that after the removal of the lacrimal sac it is usually necessary to remove the lacrimal gland also in order to stop the epiphora. My own limited experience has taught me that the epiphora is not relieved by any of the operations which have for their object a large opening into the middle meatus. For not only does the opening in the middle meatus tend to close in nearly every case, but such an opening destroys the physiological function of the lacrimal apparatus. For the lacrimal canal does not end at the so-called nasal orifice of the bony canal, but it extends backwards as far as the posterior end of the lower turbinate bone. If the outer nasal wall be examined from the interior of the antrum, it will be found that the lacrimal canal and the space under the lower turbinate form one continuous curved passage. This view of the continuation of the lacrimal passage to the posterior end of the lower turbinate is further substantiated by the observation that upon syringing the sac from the conjunctival side, the fluid does not escape from the nostril, but invariably runs back into the nasopharynx. The importance of this observation lies in the fact that the lacrimal duct is a siphon, of which the canaliculi form the short arm, the sac forms the bend of the siphon, and the duct itself forms the long arm. Any interference with the siphon retards the flow of the tears into the nose. Toti states that there is more epiphora when the canaliculi have been slit than when they have not been slit; when the sac has been excised there is always some epiphora; when a communication has been established between the sac and the middle meatus of the nose, there is an opening into the bend of the siphon, and the siphonage is destroyed, with resulting tearing. In this type of operation not only does the opening have a decided tendency to close, but as long as it remains open, the patient is continually blowing his nose through the opening into the conjunctival sac.

The operation which the writer has performed in these cases was developed as the result of practical operative experience, but nevertheless is based upon these theoretical considerations. It has for its technical object the removal of the inner and anterior walls of the bony canal, followed by slitting up the entire length of the membranous passage. In this way all obstructing constrictions are removed, whether they be in the bony or in the membranous parts, below or above. The technic has been described in detail in the *Laryngoscope* of December, 1912, and as it has not been changed since then, I will not repeat it now.

The result of the operation has been quite satisfactory, all but a small proportion of the cases having been relieved not only of their suppuration, but of the epiphora also.

Dr. E. S. THOMSON said he had read Dr. Holmes's original paper on the subject many years ago, and did at the time a good many operations, perhaps thirty. He then had an orbital hemorrhage in a patient whose gland and sac had been removed at the same sitting. The wound healed nicely but optic atrophy followed. Since then he had removed the sac as a routine and the gland less often.

Dr. A. E. DAVIS said he preferred the removal of the sac after the method of Meller, and had not interfered with the gland if the result was sufficient. He thought there must be some reason why the operation had not been more widely adopted.

Dr. ERVIN TÖRÖK removed the sac in practically all cases of epiphora. He had done a few Toti operations, perhaps twelve or fifteen, and abandoned the method as unsatisfactory. Probing had seldom proved of permanent value in his hands, nor had removal of the accessory gland. He thought the removal of the main gland not as easy as it sounds, the orbital fat being sometimes troublesome. Hemorrhage must be checked.

Dr. T. R. **Chambers** had treated his cases of epiphora for twenty years by injecting adrenalin and cocaine and afterward passing a No. 9 Bowman probe. He had been perfectly satisfied by the procedure in most cases.

Dr. **Walter Weidler** deprecated a good deal of the surgery done on both sac and gland. In most cases he had been satisfied with the results obtained by judicious probing and had not found it either tedious or especially painful.

Dr. A. J. **Herzig** had seen a number of the cases of Dr. Wiener and been very much impressed by the results obtained.

Dr. A. E. **Prince**, of Springfield, Ohio, wrote that he had operated upon about 300 cases of lacrimal obstruction during the past four years in the following manner:

After slitting the canaliculus and enlarging the opening into the sac with sharp pointed Stevens scissors sufficient to admit a large probe, a gouge 4 *mm* in diameter is introduced, held at an inclination of 45° laterally and 30° forward. A blow of a mallet drives it directly into the middle meatus. By means of a circular punch with a conical end the bone and soft tissues surrounding this opening are removed. A large communication is thus established and a very large probe can be introduced at intervals by the patient himself. Fifty per cent. of the cases thus operated upon had permanent drainage and were free from tearing. The balance required a second operation which consisted in the following: A cataract knife is introduced through the scar tissue occupying the field of the fistula. The punch is again introduced and the opening enlarged and the probe treatment begun. Eighty per cent. of those operated upon the second time are cured, as the nasal epithelium joins that of the lacrimal sac. About 10% of the cases have failed. Some of these failed to drain, although there is a very large opening from the sac into the nose. In others the opening has again closed after the second operation, while some have ceased treatment.

Dr. **Wiener** in closing the discussion complimented Dr. Yankauer very highly on his technique but did not think the final result likely to be at all permanent. He was pretty sure they would all end like the Toti cases, the opening closing.

Dr. **Holmes** wished to emphasize the view that tear sac troubles always began in the nose and should be treated from that point too. Only a man who had practical experience in both branches could appreciate the immense importance of sinus and nasal conditions in eye diseases. He, too, thought the opening made in the Yankauer type of operation was sure to close in the end, and could not see any reason for wasting time with probes when the whole trouble could be removed with the sac and gland.

Dr. S. Agatston presented a child with a **congenital coloboma of the macula** in both eyes, a girl, 11 years of age, complaining of poor vision since infancy. There was a relative central scotoma in both eyes but no nystagmus. Eccentric vision was $\frac{20}{100}$. The patient never learned how to read or write. The fundi showed a well-defined circular area at the location of the macula, in which the white sclera was marked by the presence of choroidal blood-vessels and irregular patches of pigment. The only other possible diagnosis could be congenital central choroiditis. Wassermann test was negative.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By Mr. HENRY DICKINSON, London.

A meeting of the Section was held on Friday, March 28th, Mr. W. T. Holmes Spicer, President of the Section, in the chair.

Mr. Elmore Brewerton exhibited a patient whose retina presented a peculiar series of **angeoid streaks.** He brought the case because of the extensive character of the change, and though the condition seemed to be rare, he understood Mr. Spicer had seen the appearance in more than one of his cases. On looking into the literature, he found that Ward Holden attributed such streaks to the remains of diffuse hemorrhage in a linear direction through the layers of the retina. But the exhibitor could not imagine blood to follow such lines, except in the nerve fiber layer, and these streaks were not in that, but posterior to it. W. T. Lister believed the streaks to be vestiges of new vessels along whose course were arranged exudates which had undergone secondary pigmentation. The streaks in this case, however, Mr. Brewerton did not think were new vessels, as, in the left eye, they met in a lake or pool round the disk, and one could not think of a vessel extending all the way round the disk. In a case reported by Zentmayers that observer said an extravasation of blood was present while the streaks were visible. His own view was that the streaks were the remains of hemorrhage between retina and choroid. Their brown color reminded him of hæmatin.

The President did not think any explanation yet given of these appearances was satisfactory. He had a brother and sister with an identical condition, except that the pigmentation in those was more marked than in Mr. Brewerton's case. All four eyes of those two patients were involved in the same way. In them, it seemed impossible to escape the view that the lines were essentially blood vessels. Another case in which he saw the streaks was that of a very anæmic man, whose condition of health was due to severe hæmatemesis. In the present case the streaks were not on the surface of the retina, as the retinal vessels could clearly be seen coursing over them; their position must be between retina and choroid.

Miss ROSA FORD showed a patient with **congenital pigmentation of the cornea,** the pigment appearing in vertical lines.

The PRESIDENT mentioned cases of the kind he had seen, the pigmentation being quite deep, and the lines being, as in this case, vertical. It was not uncommon to meet with staining apart from ulceration, in which case there might not be vessels in the site.

Miss FORD also showed a case of what she regarded as **pituitary tumor,** though she was unable to find signs of disturbance of pituitary secretion. There was, however, marked contraction of fields and left homonymous hemianopia and a scotoma in the right field of the right eye. Skiagraphically, the sella turcica appeared to be normal.

Mr. GRIMSDALE exhibited a patient with a **pulsating tumor of the orbit** which he regarded as aneurysmal. It appeared to be connected with the supraorbital vessels, and compression of the carotid artery on the same side caused the pulsation to cease. The patient was only 13, a very unusual time of life for such a tumor.

Mr. RAYNER BATTEN showed a patient with **disease of both maculæ.** Three years ago she had acute papillitis, and in the course of a fortnight lost her sight completely. Three months later she could just discern light. She now had opaque white disks and symmetrical disease of the maculæ. A feature about similar cases he had seen was, that the condition occurred at about puberty. This girl had no menstruation for a year.

Major CARRUTHERS showed an **intraocular growth** in a soldier back from the Rhine Front. When seen, the left eye was much proptosed, and X-rays showed an increased shadow on the left side. The Wassermann test proved negative. The history given by the man was one of four months—the papers had not come through—and the first symptom noticed was diplopia. He had 4 D. of optic neuritis. The growth was quite hard. On the advice of a colleague, the man was put upon mercury and iodides, and this was soon followed by a remarkable chemosis, entirely of lymphatic nature: there was no redness, congestion, or vascular engorgement. After 48 hours, this cleared up, and the proptosis and optic neuritis subsided a great deal. He was hoping it would turn out to be a gumma, and therefore curable. But the improvement stopped short of cure, and recently there had developed keratitis punctata. He believed the sinuses to be normal.

Mr. A. W. Ormond showed a case of **pituitary tumor.** At first he thought the optic discs were involved secondarily to some nasal trouble, therefore he handed the case over to his rhinological colleague, who explored both antra and the sphenoid, and removed the anterior end of each turbinal, but without finding anything very definite amiss. He then had the skull skiagraphed, and found the sella Turcica much enlarged, so that the body of the sphenoid seemed to be eroded away. The visual fields were atypical, as the hemianopia was more on the nasal than on the temporal side. The optic neuritis on both sides, the fact that the patient was gaining flesh, and the general picture, taken with the X-ray disclosures, made him strongly suspect a malignant tumor of the pituitary body. He asked for opinions as to whether puncture should be done through the sphenoid, on the chance of relieving the patient if it should prove to be a cyst.

Mr. J. H. Fisher agreed there was great probability that this was malignant growth with very extensive destruction of the sella Turcica. The absence of the typical signs of a tumor starting in the pituitary body, and the absence of the secondary phenomena which pituitary tumors manifested in other parts of the body, pointed to its malignancy. He did not advise puncture.

Mr. L. V. Cargill also showed a case of **pituitary tumor,** in a man æt. 22, who looked 16. He had left temporal hemianopia and contraction of the right field. Both discs were pale, and there was considerable enlargement of the pituitary fossa, especially antero-posteriorly.

Mr. J. H. **Fisher** said this case was much more like one of primary disorder of pituitary than Mr. Ormond's. There were disturbances in the secondary sexual characteristics, and the extension in the sella Turcica was of a more typical character. He still had under observation a patient, now 35 years of age, in whom the pituitary trouble had been in abeyance for 20 years. In him there was infantilism, coupled with the secondary sexual characteristics remaining undeveloped. He thought an attempt should be made to differentiate cases of disease of the pituitary body itself, and those in which the growth was in its neighborhood.

Dr. **James Taylor** agreed with Mr. Fisher's view. Before anything of an operative nature was undertaken, he counselled feeding the patient upon pituitary extract. If that did not succeed in giving relief, perhaps benefit would be secured by operation, especially if it proved to be a cyst. Mr. Cargill replied that this patient had been fed upon the extract of the gland.

The same subject was dealt with in a paper by Captain **Maxted**. The patient had the usual symptoms. His diplopia was preceded by intermittent headaches, not severe. The right palpebral fissure was wider than the left: the right pupil semi-dilated and fixed: no consensual reaction. There were attacks of epistaxis, which were attributed to a pharyngitis. He had increasing anæmia. Lumbar puncture showed that the cerebrospinal fluid was under considerable tension. The fluid gave a negative Wassermann. Later the patient became dizzy. The trans-sphenoidal decompression greatly relieved the headaches. The right sphenoidal sinus was explored and found to be filled with a soft hæmorrhagic mass, resembling growth: the posterior wall of the sinus was destroyed. On recovering from the anæsthetic, the patient noticed that his sight was much worse, and in a few hours he was practically blind. On the following morning he was completely blind, and neither pupil reacted to light. Five days later the blindness began to clear up. Ten days after the operation vision was R. $\frac{1}{60}$, L. $\frac{4}{60}$: six weeks after operation R. $\frac{6}{60}$, L. $\frac{6}{24}$. The hæmorrhagic discharge from the nose continued, the anæmia progressed. A further exploration of the nose was carried out, and vascular growth removed. A tube of radium, of 100 mgs. strength, was inserted, but five days after that the temperature went up, the patient became delirious, collapsed, and died. **Post mortem,** a large growth was found in the region of the sella Turcica, with the optic chiasma stretched over it. There was much erosion of surrounding structures. Both cavernous sinuses were extended to three times the normal size with masses of tumor. There was great destruction of bone in the middle area of the base of the skull.

The paper was discussed by Mr. Fisher and the President.

Mr. J. HERBERT FISHER read a paper on **migraine.** He said the primary classical symptoms of the condition were the scintillating scotomata, followed by localizing, and usually unilateral, headache, which latter culminates in nausea, or even vomiting. In his own case at least two others had been constant: a marked reduction in the pulse rate during an attack, and a definite increase in renal activity, resulting in copious pale urine. He had never experienced one of the type-symptoms, disturbance of vision. His headache was always in the left temporo-frontal position, and nausea was usual. His attacks usually lasted 48 hours. Sometimes his pulse, during attacks, was as low as 46 beats per minute. During a severe attack his alimentary activity appeared to be in abeyance. Often in this disease there was a familiar tendency. In the female the attacks often coincided with the menstrual periods, and in many cases they ceased during pregnancy, ceasing for good with the onset of the climacteric. In the male the attacks usually stopped at about the fiftieth year. The migraine spectrum usually lasted 20 to 30 minutes, as contrasted with the few seconds' duration of the visual aura of epilepsy, the latter also being much more highly organized. It probably had a different explanation in the two conditions. The migraine spectrum was always symmetrical, but various parts of the field might be involved. He thought the visual spectra of migraine were produced by irritation of the visual nerve fibers at the base of the brain. The hemicrania developing on the side opposite to the homonymous scintillating scotoma well agreed with the idea that the scotoma was initiated in the optic tract. There appeared to be only one region in which a lesion, varying in character, could reach the various parts of the basal fibers, so as to explain all varieties of the migraine scotoma, namely, the inter-peduncular, and he now suggested the pituitary body as the exciting agent. Slight swelling of the hypophysis would result in sufficient pressure to cause irritation of visual fibers in any of the required positions. And the cessation of migraine during gestation, when the pituitary was greatly modified, and at the climacteric, when the sex power was on the wane, all seemed to favor the view. So also did the renal activity, for the pituitary secreted a hormone which has a direct effect on renal epithelium. He had not expected to find visible changes in the region by X-rays, because there were probably no bone changes.

Dr. GORDON HOLMES pointed out that Mr. Fisher's suggestion had already been put forward by another observer, the reference he would supply. He was sceptical about the theory. If it were true, one would expect to find migrainous phenomena pretty frequently in pituitary tumor cases, in those in which that body was enlarged, either by tumor formation or physiologically. He was not aware of such phenomena occurring in those cases. His own migrainous attacks were marked by definite visual changes.

Dr. JAMES TAYLOR thought the condition of the blood pressure would be a better guide to pituitary influence than pulse rate. He looked upon migraine as simply evidence of cortical irritation.

Mr. LESLIE PATON described in detail the features of the migrainous attacks to which he had been subject for a number of years, an interesting point in which was the perception of an organized complex visual aura, always in the same setting.

Mr. M. S. MAYOU was similarly afflicted, and his attacks were cut short by copious libations of Contrexville waters.

Mr. J. H. PARSONS, F. R. S. and Mr. J. B. STORY continued the discussion.

COMBINED MEETINGS OF SECTIONS OF OPHTHALMOLOGY AND LARYNGOLOGY

These Sections held a combined meeting on Wednesday, April 2d, Mr. W. T. HOLMES SPICER occupying the chair. The subject of discussion was:

Injuries and Inflammatory Diseases Affecting the Orbit and Accessory Sinuses

The Chairman expressed the hope that great good would come from the present meeting, which arose from the desire of ophthalmic surgeons to know a great deal more about the dangers which beset the precious optic nerve in its course from the eye to the brain. He remembered the time when there was but little expert knowledge concerning the ethmoid and frontal sinuses, and when the departments of Ophthalmology and Laryngology at large hospitals were in charge of physicians, and the outlook upon them was purely medical. It was very important that the ophthalmologist should know when to call in an expert to deal with defective sinuses.

Mr. L. V. Cargill opened the discussion. It was, he said, surprising to find that cases of optic complications from sinus trouble were so few, because of the thinness of the partition dividing sinus from orbit. Ophthalmic complications might present themselves as functional disturbances, or as toxic effects. There might be contraction of the peripheral field, central scotoma, papillœdema, papillitis, uveitis, episcleritis, sub-retinal effusion, retinal detachments, and so on. Nasal sinusitis was a chief cause of orbital inflammation. There was a small group of cases comprising retrobulbar conditions, and a larger one consisting of sub-periosteal inflammations caused by extension from the nasal sinus. In ethmoidal cases, an acute specific fever seemed to be the usual primary cause. In young children, acute cases often responded to fomentation and good nursing. He asked whether the staff of ophthalmic hospitals should not include a rhinologist. If, in suspected sinusitis, expectant treatment was not succeeding, an exploratory incision should be made without delay. In this war, the proportion of injuries inflicted by shell fire compared with those by rifle bullets was higher than in the South African War, and the sinuses had suffered in a correspondingly greater degree. Practically every case in which the wound was purely orbital had made a good recovery. The general results had been definitely aided by anti-tetanic serum, stereoscopic radiography, the telephone probe, and the electro-magnet. No attempt had been made to remove deeply situated foreign bodies unless they were causing definite trouble. The essence of sinus treatment was efficient drainage and irrigation. He described and illustrated a variety of cases.

Mr. G. Seccombe Hett remarked on the benefit of such co-operation among experts, not only in regard to the more efficient treatment of war injuries, but also cases of injury met with in industrial practice and in disease. His experience during the last three years had been with cases from the war after their arrival in England. The best results followed free drainage and as little movement of bony and soft tissues as possible. Mucous membrane was stitched to skin, and was not taken away. In a number of cases he had been able to re-constitute an eye socket because the conjunctival mucous membrane had been retained. He showed an instructive selection of slides illustrating treatment in a variety of conditions.

Mr. A. W. Ormond based his contribution on the cases which had come under his care at the 2d London General Hospital during the last four years, and in particular on 100 cases. He could not say that serious damage to orbit or sinuses had resulted in any subtle change in vision: the results were those of the original injury, or of inflammatory change set up by it. In some patients there was optic neuritis in the uninjured eye. Pain arising in consequence of inflammation of the sinuses was sometimes referred by the patient to his eye. In two cases, blind eyes had been removed on account of severe pain supposed to originate in them, but it was found to have arisen in the nasal condition. Sometimes a deep wound was found to have affected four sinuses.

Mr. E. D. Davis spoke of his experiences in this connection at casualty clearing stations. He had been struck with the frequent occurrence of a fissure-fracture of the roof of the orbit when making post mortem examinations in cases of bullet wounds of any part of the skull. Fracture of the anterior fossa was accompanied by diffuse intradural hemorrhage, and these cases usually succumbed in twenty-four hours. Even if this period was survived, death took place in from three to six days, from basal meningitis, due to infection of the wound cavity. In cases of sinus injury, he regarded early suture as very important. He asked for opinions as to the wisdom of draining severe orbital cellulitis through the nose.

Suppuration of the antrum, of nasal origin, was nearly always accompanied by suppuration of other sinuses also, but in cases where the suppuration in the antrum was due to the condition of the teeth, the antrum remained the only cavity involved, and in such cases no retrobulbar neuritis had been recorded.

Mr. H. D. Gillies expressed his objection to the early suture advocated by Mr. E. D. Davis. In the honeycomb presented by the sinuses one could not excise the whole wound, and early suture meant giving a good deal of trouble in the later stages of (restorative) treatment. Excision of the wound in a fleshy part was quite justifiable, but it was not possible in the sinus region. In the next Bolshevik war the best practice would be found to be to keep entrance and exit wounds open as much as possible, so as to permit of efficient drainage until no question of suppuration remained. Very great benefit had resulted in the treatment of war injuries by the coöperation of the dental and the plastic surgeon, and he hoped much from the combination of the efforts of rhinologists and ophthalmic surgeons, of which this meeting was an earnest.

Mr. D. Leighton Davies spoke of the effects of nasal sinus affections on the fields of vision and on the ocular muscles. Some cases of heterophoria were secondary to sinus affections. The fields should always be studied, because patients did not make voluntary complaint in this respect. He had never met with a case of chronic nasal suppuration which did not show some changes in the visual fields. There might be scotoma, or an enlargement of the blind spot. When sinus disease had been operated upon, the blind spot enlargement subsided, only to again enlarge if the nasal trouble returned. Even when the field of vision was reduced to 10 degrees, he did not find the patients complain of difficulty in orientation. If the sinus trouble had been long-lasting, its cure did not always result in complete restoration of visual fields. In discussing the etiology, he said no one theory yet advanced would account for all the cases. The discharge from the involved sinuses, being swallowed, set up a toxæmia, which so spread to the eye. If that were true, one might expect to find contraction of visual fields in association with suppuration in other parts of the body, but he had not yet found that in sufficient numbers to warrant the drawing of conclusions. He had, however, found contraction of fields in cases of chronic suppurative osteomyelitis, chronic otorrhœa, and leucorrhœa with endometritis.

The debate on this subject was resumed on April 10th, the chair being occupied by Dr. JAMES DONELAN, the President of the Section of Laryngology.

Mr. W. M. MOLLISON, in reopening, said most of the cases of the kind under discussion which he had seen were those which had been under the care of Mr. Ormond on account of damage to the eyes, and he did not see them until some months after the receipt of the injury. He had been impressed with the amount of time and trouble and suffering on the part of the patients which might have been saved if an ophthalmologist and a rhinologist had attended the cases from the commencement. This was specially so in the cases in which drainage into the nose might have been effected before any attempt was made to repair lids or sockets. When the latter had been done there was often a persistent pus discharge. He divided the cases he had seen into clean through-and-through bullet wounds, and secondly all other kinds. The usual result in the former was adhesion between outer wall and septum. Infection of sinuses was generally a sequel of the obstruction. All the cases he saw—at St. Dunstan's—were blind, some completely so. In one case, in restoring the nasal air-way, he opened an adhesion between the septum and ethmoid, and infection of meninges took place. The result appeared to be very good, but three weeks afterwards the officer developed meningitis and died in three days. In some there was parosmia, due to damage of the olfactory nerve. Among the men at St. Dunstan's he found the sinus most frequently affected was the frontal: the proportion was 13 frontal, 2 antral. In some cases the deep wall of the sinus had been fractured and dura mater exposed. One man was wounded by a shell in May, 1917; shrapnel entered the right side by the canthus, and he had a sinus round the right inner angle of the orbit. At the operation a very extensive ethmoiditis was found, and there was a large piece of khaki clothing in the ethmoid, which had been there seven months. He had not yet discovered a case of sinus suppuration in connection with retrobulbar neuritis, though he explored in a routine way with a Killian's speculum. He had seen only one case of orbital cellulitis which could be called idiopathic. It was that of a girl who was admitted into Guy's Hospital desperately ill. He could find nothing wrong with the sinuses. She died in two days of most extensive pyæmia, and no primary source could be discovered. In 99% of these cases he thought the sinus at fault was the frontal.

Mr. J. F. O'Malley said he had notes of about 60 cases of trouble in nasal and accessory sinuses in which there were also eye lesions and injuries of the lacrimal apparatus. In the case of wounds of the ethmoid he had found that where there was previous obstruction sepsis was invariably present, and free incision and thorough drainage were needed. But he had been struck by the fact that in a large percentage of his ethmoidal cases there was so little sepsis that extensive treatment was not called for beyond the removal of adhesions. In the case of gunshot wounds, there was great facility in healing once a good air-way had been reëstablished: this in contrast with ordinary ethmoid involvement secondary to nasal inflammation. Much the same could be said of antral lesions. Out of 50 through-and-through wounds of the antra he had only to operate on 11 for sepsis; in 11 others he operated for the removal of foreign bodies. He had 18 cases of eye involvement: in 10 the eye was lost, in 8 there were injuries to it of varying degree. Where the injury to the eye was not direct, it seemed to have been caused by the missile striking the malar bone and the shock of impact being communicated to the bony wall of the orbit. In some cases where epiphora resulted, this did not give much trouble in the ordinary way, but when playing games in a high wind, or motoring, the overflow of the tears was a nuisance. He thought the cause was hypertrophy of the inferior turbinate due to exposure to the winds, and as a result of its engorgement pressure was exerted on the tear duct. Removal of a portion of the soft tissue of the anterior turbinate seemed to cure this climatic cause of overflow.

Mr. G. H. Pooley said orbital cellulitis was often due to extension of inflammatory trouble in the superior ethmoidal sinus or from the lacrimal apparatus. In children, orbital cellulitis was often due to osteomyelitis in the frontal or ethmoidal region, and frequently these cases die. The best treatment was free incision, and the generous use of the sharp spoon. Defective vision due to nasal conditions he thought was attributable to pressure on the optic nerve, or to toxic influence on the retinal cells. He described three classes of cases.

Mr. W. STUART-LOW spoke of cases in which œdema spread to the canthus from inflammation of the frontal sinus. In some of the cases sent for operation, in which the middle turbinal was swollen and was blocking the passage, he avoided operation by using cocaine and adrenalin, following that, after an interval, by fomentation. He did not operate until he had tried some such measures. Relieving the tension in a sinus, which might be due simply to serous fluid, was of great benefit. If these means failed, he received the patient into the hospital and incised freely under the eyes. He refrained from washing out the frontal sinus, for fear of driving infecting material into other sinuses. Removal of two thirds of the middle turbinal often succeeded. He also made a practice of using a cage over wounds of sinuses and ears, to obviate pressure from outside, and he believed that had much to do with preventing or reducing subsequent deformity. Some of his lacrimal cases he failed to cure, and then he generally found some small foreign body was the cause of failure. He employed washing out in the case of the antrum, for its partition, though thin, was complete. When a portion of shrapnel or casing was deeply embedded, he did not attempt removal unless it was giving the patient trouble.

Mr. HERBERT TILLEY showed photographs to demonstrate that ethmoidal cells and frontal sinus were developed quite early, even at three years of age. He also exhibited skiagrams of cases. He said that sometimes frontal sinus inflammation caused contralateral retrobulbar neuritis. Subjects of sinus suppuration seldom complained of eye symptoms, and even when asked directly about them did not admit such. In cases which had been referred to him by ophthalmological colleagues, having gone to them because of retrobulbar neuritis, he seldom found sinuses involved, which he attributed to the fact that the originating nasal trouble had cleared up in the meantime. The rapidity with which eye symptoms cleared up when nasal trouble was treated seemed to show that the cause was pressure of fluid rather than actual sepsis. Radical measures should never be undertaken during acute intranasal infection: it might mean disaster to the eye, or even to life. At this stage the surgeon should be satisfied with providing free drainage. He had seen iritis, cyclitis, and some internal affections of the eye quite cured by intranasal operations. He had never seen a case of orbital cellulitis in which sinus suppuration was not present.

Mr. LAWSON WHALE brought out, by means of an epidiascope demonstration of selected skiagrams from his war experiences in France and England, a number of points of practical importance in diagnosis and treatment.

After a few closing remarks by the Chairman, the four openers briefly replied.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY FOR THE FOURTH QUARTER OF 1918 AND THE FIRST QUARTER OF 1919.

By H. Koellner, Berlin; W. Krauss, Marburg; R. Kümmell, Erlangen; W. Loehlein, Greifswald; H. Meyer, Brandenburg; W. Nicolai, Berlin; H. Pagenstecher, Strassburg; K. Wessely, Würzburg; and M. Wolfrum, Leipsic; with the Assistance of Drs. Alling, New Haven; Calderaro, Rome; Causé, Mayence; Curran, Kansas City; Danis, Brussels; Gilbert, Munich; Groenholm, Helsingfors; v. Poppen, Petrograd; Treutler, Dresden; and Visser, Amsterdam.

Edited by Matthias Lanckton Foster, M.D., F.A.C.S.,
New Rochelle, N. Y.

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2. Friedenwald, H. **Ophthalmoscopic conditions simulating sarcoma of the choroid.** *American Journal of Ophthalmology*, December, 1918.
3. Landolt, Marc. **Regarding the question of hereditary changes produced by artificially induced somatic modifications.** *Archives d'ophtalmologie*, xxxvi., 1.
4. Rasquin, E. **The determination of "professional" visual acuteness and the evaluation of visual reduction caused by military service.** *Annales d'oculistique*, clv., 3.
5. Terrien, F. **A simple method of recognizing simulated diplopia.** *Archives d'ophtalmologie*, xxxvi., 1.
6. Von der Heydt, R. **Ophthalmoscopy with red-free light of Vogt.** *American Journal of Ophthalmology*, February, 1919.
7. Wheeler, J. M. **Paralysis of the sixth cranial nerve associated with otitis media.** *Journal of the American Medical Association*, November 23, 1918.
8. Wilmer, W. H. **The effect of altitude on ocular functions.** *Ibid.*, October 26, 1918.

Coulomb (1, **Disinfection of artificial eyes**) found that a new artificial eye is more easily sterilized than an old one.

The only practicable method he thinks is to immerse it for one minute in a solution of one part iodine, two parts potassic iodide, and three hundred parts water.

SCHOENBERG.

FRIEDENWALD (2, **Ophthalmoscopic conditions simulating sarcoma of the choroid**) reports the case of a bluish tumor of the fundus, 0.5*cm* by 0. 75*cm*, and about 2*mm* thick, in a girl eighteen years old. Subcutaneous tuberculin test and the Wassermann reaction were negative. As the mass was thought to be sarcoma and was increasing in size the eye was removed. The microscopic findings were typical of an infection granuloma either tuberculous or syphilitic. He also describes the case of a boy of twelve, whose right eye showed a large tumor projecting into the vitreous. There was a marked dilatation of the retinal vessels with mild optic neuritis and patches of white exudate. Under microscopic examination the mass proved to be an inflammatory exudate which was undergoing organization. These cases are known as those of massive exudation of Coats.

ALLING.

LANDOLT (3, **Hereditary changes produced by artificially induced somatic modifications**) publishes the results of an examination made by his father on several hundred guinea pigs with ocular lesions. These animals, which showed corneal changes, were the offspring of guinea pigs, in which the great physiologist Brown-Sequard had induced ocular lesions through a section of a certain portion of the brain. Landolt's studies brought out the fact that these corneal lesions were of traumatic nature and had nothing to do with the question of heredity, so that Brown-Sequard's experiments could not have any value in the controversy between Weismann and Lamarck as to the possibility of transmission of artificially induced somatic modifications.

SCHOENBERG.

RASQUIN (4, **The determination of "professional" visual acuteness and the evaluation of visual reduction caused by military service**) points out the inadequacies of the methods at present in use for the determination of the amount of reduction of visual acuteness necessary to cause professional disability, and endeavors to work out an improvement upon these methods. His idea is that the question of evaluation of the compensation for partial or total loss of sight has to be based upon the percentage of loss of the capacity for the performance of a given occupation or trade. From repeated tests of a large number of individuals he concludes that the Snellen test chart and those containing various sizes of E with the three horizontal lines equal in length, though not ideal are the most satisfactory. The paper contains a table which shows the valuation of professional visual acuteness according to the sizes of the types seen. In this table the increase of the types used follows a geometrical progression, while the corresponding professional visual acuteness follows an arithmetical progression.

SCHOENBERG.

TERRIEN (5, **A simple method of recognizing simulated diplopia**) holds a blue glass in front of the patient supposed to have diplopia and examines him with the candle in the usual manner. He then places another blue glass, but which is opaque, in front of the same eye and reëxamines the patient for diplopia. The malingerer will see double.

SCHOENBERG.

VON DER HEYDT (6, **Ophthalmoscopy with red-free light of Vogt**) describes the appearance of the normal fundus when seen by light filtered through colored fluids to eliminate the red rays of the spectrum. The nerve fibers are plainly visible and can be followed all over the fundus. The vessels are black on a light background. The foveal reflex, ordinarily seen in youth, can be seen even in the aged. The macula is yellow, and, as all pigment appears black in this light, he concludes that there is no pigment in the macular region. Fundus details and lesions are demonstrated very clearly.

ALLING.

WHEELER (7, **Paralysis of the sixth cranial nerve associated with otitis media**) describes Gradenigo's syndrome as characterized by acute otitis media, isolated paralysis of the abducens, and intense pain in the frontal temporal and parietal regions. The sixth nerve pierces the dura and passes upward and outward, in contact with the apex of the petrous pyramid of the temporal bone, entering the cavernous sinus. Any inflammation or hemorrhage at this point would cause pressure on the nerve. The pain is explained by the proximity of the Gasserian ganglion. The prognosis is usually good if the process in the temporal bone is relieved by operation.

ALLING.

The experiments reported by WILMER (8, **The effect of altitude on ocular functions**), as part of the work of the Medical Research Board to investigate problems in aviation, were intended to show the effect of high altitudes on the eye. Both the rebreathing apparatus of Henderson and a low pressure tank were used to duplicate the conditions in actual flying. Stereoscopic effect, reaction time, color vision, field of binocular fixation, muscle balance, field of vision, perception of motion, accommodation, convergence, and retinal sensitivity were all tested under reduced air pressure. In general it can be stated that these functions were reduced but not to a marked degree until the equivalent of 20,000 feet was reached and the eyes quickly returned to normal after the administration of oxygen proving the signs observed were due to deficiency of that element.

ALLING.

II.—THE EYE IN ITS RELATIONS TO GENERAL DISEASE.

9. CLARK, H. S. **Familial degeneration with or without dementia.** *Journal of the American Medical Association*, November 30, 1918.

10. DENNIS, D. N. **A study of the conjunctival circulation to determine early signs of arteriosclerosis.** *Transactions American Ophthalmological Society*, 1918.

11. DWYER, J. G. **Focal infections of the eye from the intestinal tract.** *Journal of the American Medical Association*, December 21, 1918.

12. HANSELL, H. F. **Ocular affections dependent upon disease of the tonsils.** *Transactions of the American Ophthalmological Society*, 1918.

13. LAVAGNA, L. **Late ocular complications in cerebrospinal meningitis.** *Clinique ophtalmologique*, viii., 10.

14. LEMIÈRE, L. **Transitory amblyopia in a patient with commotion of the brain.** *Annales d'oculistique*, clv., 2.

15. NECHITCH, G. P. **A study of hemeralopia.** *Ibid.*, clv., 4.

16. TYSON, H. H. **Transient left homonymous hemianopsia.** *American Journal of Ophthalmology*, December, 1918.

Cases of familial degenerative disease may be divided into (1) amaurotic family idiocy, (2) juvenile type of the same, (3) familial macular degeneration without dementia, and (4) the same with dementia.

There is no sharp line of differentiation between these types as, for example, the second form seems in some cases to merge into the first or third.

CLARK (9, **Familial degeneration with or without dementia**) reports two cases of the fourth type. As to the causes of these affections we are in the dark. Pathologically amaurotic family idiocy shows degeneration of the ganglion cells of the retina and central nervous system but in macular cerebral degeneration the neuroepithelium is probably the seat of the lesions.

ALLING.

DENNIS (10, **A study of the conjunctival circulation to determine early signs of arteriosclerosis**) with the aid of a Zeiss corneal microscope and a small spot light has studied the vessels of the ocular conjunctiva and finds here very early manifestations of general vascular sclerosis. He observed that the corpuscles cling to the lumen of the vessel and interrupt the flow of blood so as to leave its distal portion empty for a time, and also to cause a beaded appearance. In advanced cases of vascular sclerosis the vessels are nearly empty.

ALLING.

DWYER (11, **Focal infections of the eye from the intestinal tract**) has studied the intestinal reactions with the view to establishing a normal growth of the colon bacillus which cannot live in highly acid or alkaline media. After irrigation with either an alkaline solution or lactose, as the reaction demands, he injects a culture of the colon bacillus and gives the Bulgarian bacillus by mouth. He has had marked success in the treatment of eye diseases where of course other recognized foci of infection have been excluded.

ALLING.

HANSELL'S (12, **Ocular affections dependent upon disease of the tonsils**) two cases are as follows: Acute double optic neuritis with complete blindness. A careful examination revealed no cause for the eye lesion except diseased tonsils. Within twenty-four hours after their removal vision began to return until nearly normal, although the nerves passed into partial atrophy. The other case was chronic iridocyclitis with acute exacerbations persisting three months. Recovery was rapid and complete commencing within a few hours after tonsillotomy. ALLING.

LAVAGNA (13, **Late ocular complications in cerebrospinal meningitis**) reports an unusual case of conjunctivitis, iridochoroiditis, and optic neuritis which appeared one year after an attack of cerebrospinal meningitis with septicæmia. The conjunctival secretion showed the presence of meningococci. After two months' treatment the ocular condition subsided, but two months later a retinal detachment appeared in the same eye quite suddenly. The author does not report on the subsequent course of the disease.

SCHOENBERG.

LEMIÈRE (14, **Transitory amblyopia in a patient with commotion of the brain**) reports the case of a soldier who, after having passed through a day of terrific bombardment, became unconscious and on waking found himself completely blind. The loss of sight gradually disappeared in the course of a few days. The eyes showed nothing abnormal during the time of amaurosis. The author believes that this transitory loss of sight was due to a commotion of the cortical or subcortical visual areas with a disturbance of the vasomotor function.

SCHOENBERG.

NECHITCH (15, **A study of hemeralopia**) has had the opportunity to examine seven hundred Serbian soldiers with hemeralopia and draws the following conclusions: (1) The condition is due to a state of exhaustion of the organism, due mainly to undernourishment, and lack of variety of food and of fats. (2) The retinal sensibility is not diminished uniformly over its whole surface. He classifies hemeralopia as (a) total; (b) with peripheric vision; (c) with eccentric vision; (d) with relative scotoma; (e) with annular scotoma. (3) Hemeralopia is almost always bilateral and never changes its character. (4) Improvement and even spontaneous cure are not rare, but not of long duration. (5) The defective nutrition reduced the photochemical reactions in the retina and thereby caused a diminished retinal sensibility. (6) The best means of treatment, in the author's hands, was cod liver oil, and subconjunctival injections of natrium chloride, 5% solution, nourishing food, iron, and arsenic. SCHOENBERG.

TYSON (16, **Transient left homonymous hemianopsia**) reports the case of a man who developed an hemianopsia after free indulgence in alcohol, the attack persisting nine days with restoration of vision. Eight months later after another spree he had a recurrence followed by recovery except for a permanent homonymous superior quadrant achromatopsia. He thinks that the attacks were due to prolonged spasm of the right posterior calcarine artery causing œdema of the cortex about the calcarine fissure. Alcohol accompanied by a constitutional migraine dyscrasia was the exciting cause.

ALLING.

III.—PATHOLOGY AND BACTERIOLOGY.

17. MAXCY, K. F. **The transmission of infection through the eye.** *Journal of the American Medical Association*, March 1, 1919.

MAXCY (17, **Transmission of infection through the eye**) introduced the harmless saprophyte bacillus prodigiosus into the conjunctival sac and recovered it from the nose in five minutes, from the throat in fifteen minutes, and from the stools in twenty-four hours. He thus proved the possibility of infection through the eye and has offered an explanation for the well-known fact that the ordinary mask is an inefficient protection. ALLING.

IV.—INSTRUMENTS AND REMEDIES.

18. ALGER, E. M. **A new "malingeroscope."** *American Journal of Ophthalmology*, February, 1919.

19. MARBAIX. **Remarks on the utility of the Schiotz tonometer.** *Annales d'oculistique*, clv., 1.

20. TERSON, A. **The external application of mercury salicylarsenate (enesol) in ophthalmology.** *Archives d'ophtalmologie*, xxxvi.

ALGER'S (18, **A new "malingeroscope"**) instrument consists of two tubes arranged like an opera-glass. In the ends are two small apertures which can be moved nearer or farther apart. When the openings are less than the interpupillary distance, the malingerer, in looking at two exactly similar test cards about eighteen inches apart, has the sensation of binocular vision, but in fact sees the right card with the left eye and vice versa. Pretended blindness or poor vision in one eye is thus easily proved false. ALLING.

MARBAIX (19, **Remarks on the utility of the Schiotz tonometer**) reports cases of interstitial keratitis, treated for a long time with atropine, of progressive myopia and diabetic iritis, in which the use of atropine was contraindicated by the increased intraocular tension. This condition is very apt to be overlooked when the tension is taken with the fingers. The routine examination of all eyes with the Schiotz tonometer is strongly advocated by the author.

SCHOENBERG.

TERSON (20, **The external application of mercury salicylarsenate [enesol] in ophthalmology**) praises the efficacy of mercury salicylarsenate in the treatment of corneal ulcers. He says it is far superior to either the bichloride or cyanide of mercury. Enesol is a three per cent. aqueous solution of salicylarsenate of mercury and is readily decomposed by light and air. The author recommends its use not as drops, but as a bath of the eyeball, pouring it copiously over the cornea twice a day from the original ampoule containing it. There are no contraindications to its use. The cleansing of corneal ulcers and the process of repair set in very much earlier after using this than after using any other known substance.

SCHOENBERG.

V.—GENERAL TREATMENT AND DIAGNOSIS.

21. CANTONNET, A. **The "hole in the hand" test for binocular vision.** *Archives d'ophtalmologie*, xxxvi., 3.

22. DOMEC, T. **The treatment of diverse ocular affections by intramuscular injections of sterile milk.** *La clinique ophtalm.*, viii., 10.

CANTONNET (21, **The "hole in the hand" test for binocular vision**) says that if we look at a distant object through a tube with the left eye, while we hold one hand next to the extremity of the tube so as to obstruct the view of this object from the right eye, the object will appear as if seen through a hole in the hand. This interesting experiment, devised by Cantonnet, can be very easily improvised at any time; all we need is a piece of paper rolled into a tube. The explanation given to this optical illusion is that one eye sees the object through the tube, the other eye sees the hand; both images superimposed in the brain give the impression of an image seen through a hole in the hand. The author has been using this test for sometime for discovering malingerers, by holding the tube in front of the poorer eye. Lately he has also employed it to test various disturbances of binocular vision and seems to obtain almost the same satisfaction as from Remy's diploscope. In perfect muscular balance the images superimpose so that the hole is seen in the center of the palm, above or below. In case of a monocular vision it is either the hand or the object which is seen. Besides its diagnostic importance this method can be used for therapeutic purposes in strabismus. In this condition, says the author, after having corrected the visual acuity to the best possible degree, the most important step is to train the patient to use his eyes simultaneously. This method, easily understood even by children, stimulates in patients the attempt to see the object through "the hole in the hand" and once accomplishing this, the binocular vision is obtained. The great advantage of this method lies in the fact that the patient may repeat the experiment alone, several times daily, and train himself in the act of binocular single vision. The author has found his method very valuable for overcoming the habitual suppression of image of one eye, as is usually done by the strabismics and has obtained quick and accurate information regarding the various disturbances of binocular vision.

SCHOENBERG.

By intramuscular injections of sterile milk Domec (22, **Treatment of diverse ocular affections by intramuscular injections of sterile milk**) has obtained very gratifying results in a variety of ocular affections, choroiditis, iritis, cyclitis, keratitis, and blepharitis. The original part of his paper deals with the treatment of burns of the eye with sulphuric acid. Clinical and experimental observations lead him to the conviction that the use of milk injections together with local treatment reduces the unfortunate outcome of such burns to the minimum.

SCHOENBERG.

VI.—REFRACTION AND ACCOMMODATION.

23. FEREE, C. E., and RAND, G. **The inertia of adjustment of the eye for clear seeing at different distances.** *American Journal of Ophthalmology*, November, 1918.

24. LANDOLT, E. **The influence of age on the static refraction of the eye.** *Archives d'ophtalmologie*, xxxvi., 1.

FEREE and RAND (23, **The inertia of adjustment of the eye for clear seeing at different distances**) have studied the lag in adjustment of the eye to different distances. They think that these tests might be of practical value especially in aviation where rapid judgments are essential. The time required for 18 normal observers to focus from near to far objects varied from 0.5 to 1.16 sec. from far to near 0.39 to 0.82 sec.

The individuals tested were below thirty years of age and the few tests made with older persons would indicate that the time is slower. There seems also to be a definite diurnal variation. A description of the apparatus used is given in the paper.

ALLING.

LANDOLT (24, **The influence of age on the static refraction of the eye**) says that Donders' law in regard to the diminution of the static refraction in old age has to be slightly modified. He has seen several old patients in whom the static refraction increased in the course of time, so that myopes needed a stronger minus lens, hypermetropes a weaker plus, and emmetropes a minus sphere. This exception to the well-known and accepted law of Donders may be due to peculiar changes in the lens, like loss of elasticity, the development of an irregular lenticular astigmatism, a flattening of the lens, a change of the refractive power of the lens, and of its transparency.

SCHOENBERG.

VII.—THE MOTOR APPARATUS OF THE EYE.

25. AUBINEAU, E., and LENOBLE, E. **Nystagmus and myoclonic nystagmus.** *Archives d'ophtalmologie*, xxxvi., 3.

26. TERRIEN, F. **Advancement with a suture of reinforcement.** *Ibid.*, xxxvi., 1.

Besides the three recognized types of nystagmus, ocular, labyrinthine, and the one due to an organic lesion of the central nervous system, there appears to be another type, called by AUBINEAU and LENOBLE (25, **Nystagmus and myoclonic nystagmus**) myoclonic nystagmus. The characteristic points given with regard to this kind of nystagmus are that it varies all the time in its direction and intensity, being irregular, undulatory, vertical, etc., that it is frequently accompanied by spasmodic movements of the orbicularis, or of the muscles of the neck; that it is hereditary and usually found in several members of the same family, pointing to a degenerative condition, which is commonly found in all the states of myoclonic; and finally that no organic lesions have as yet been found in such patients on whom autopsies have been performed.

SCHOENBERG.

In order to prevent the suture from slipping between the muscle fibers TERRIEN (26, **Advancement with a suture of reinforcement**) secures the advanced muscle by fastening it to the eyeball with an extra suture. This is passed through the sclera just behind the insertion of the tendon to the eyeball, parallel with the line of insertion of the tendon. The suture is double armed and each of its ends is brought out through the corresponding part of the conjunctiva. After the advancement has been accomplished the two ends of the reinforcement suture are tied, pressing the muscle against the eyeball. This relieves the muscle of a good deal of traction and prevents the slipping of the advancement sutures.

SCHOENBERG.

VIII.—THE LIDS.

27. BRIGGS, H. H. **Hereditary congenital ptosis, with report of 64 cases conforming to the Mendelian rule of dominance.** *Transactions American Ophthalmological Society*, 1918.

28. WEIDLER, W. B. **Solid œdema. Report of three cases.** *American Journal of Ophthalmology*, October, 1918.

Of the 128 members of the twenty-three families, including six generations, reported by BRIGGS (27, **Hereditary congenital ptosis**), sixty-four were affected with congenital ptosis. Of those affected, thirty-three were males, thirty females, and one of unknown sex. If the deformity ptosis is dominant, there should be, according to the Mendelian law of transmission, an equal number of those affected and those who are not. Further, the transmission of the dominant character is through the affected parents only, and in every case the dominant should have only one parent affected. His cases conform to these laws.

ALLING.

WEIDLER'S (28, **Solid œdema**) cases were characterized by recurrent localized œdema of the lips, cheeks, and eyelids, simulating angioneurotic œdema. The condition has been attributed to streptococcic infection, but in these cases the staphylococcus was found twice and a diplococcus once. The cases did well under vaccine treatment and attention given to the nose.

ALLING.

IX.—THE ORBITS AND ACCESSORY SINUSES.

29. CONLON, F. A. **Bitemporal hemianopsia due to acute suppuration of the posterior nasal sinuses.** *American Journal of Ophthalmology*, February, 1919.

30. ONFRAY, R. **Congestion of one orbit and abscess in the other.** *Annales d'oculistique*, clv., 2.

31. POSEY, W. C. **Report of four cases of orbital tumors successfully removed with preservation of vision through an orbital incision along the external rim.** *Transactions American Ophthalmological Society*, 1918.

32. POULARD, A., and REAL. **Enlargement and shaping of the orbital cavity for prothesis.** *Annales d'oculistique*, clv., 1.

33. SCHWENK, P. N. K., and POSEY, W. C. **Some observations on the restoration of the orbital socket.** *Transactions American Ophthalmological Society*, 1918.

The fibers of the optic nerve going to the nasal side of the retina are in contact with the lateral wall of the sphenoidal sinus, and this wall is very thin. CONLON (29, **Bitemporal hemianopsia due to acute suppuration of the posterior nasal sinuses**) relates a case of acute sinusitis with bitemporal hemianopsia. Such cases are very rare.

ALLING.

ONFRAY (30, **Congestion of one orbit and abscess in the other**) has seen a young boy with an orbital abscess following an ethmoiditis on the right side and an œdema and congestion of the orbital tissue on the opposite side, occurring seven months later. This time the inflammatory condition gradually receded after energetic local and general treatment with hot applications, nasal applications of eucalyptol oil, and two per cent. electrargol intravenously.

SCHOENBERG.

POSEY (31, **Four cases of orbital tumors successfully removed with preservation of vision through an orbital incision along the external rim**) began his operations with the incision recommended by Kroenlein so that the wedge of bone might be removed if it was found to be necessary. All four tumors, however, could be removed through the orbital incision. They were a spindle-celled sarcoma, a fibroma, a dermoid cyst, and an adenoma. He is favorably impressed by the operation of Magitot, which is a modification of Kroenlein's.

ALLING.

POULARD and REAL (32, **Enlargement and shaping of the orbital cavity for prothesis**) describe their method of overcoming the tendency of cicatricial bands to induce a shrinking of the orbital sockets by gradual dilatation. They use a small apparatus consisting of: (1) a plate made of hard rubber molded after and held fast to the frontal bone and the superior margin of the orbit; (2) an elastic band passed around the head, a rod of steel extending downward from this plate to the level of the interpalpebral fissure; (3) another rod directed anteroposteriorly, sliding easily in a tube provided in the vertical rod and having at its orbital extremity a discoid dilatation. After the necessary incisions have been made in the tissues of the orbit, the apparatus is fixed on the forehead of the patient, a plastic mass is introduced into the newly formed cavity and kept under pressure by the discoid end of the apparatus. The latter is removed twice daily just for the short time necessary to clean the wound. Each day a little more is added to the plastic mass and the cavity is found to have become appreciably dilated in two weeks. When it is sufficiently large vulcanized rubber is used instead of the plastic mass. The writers do not state what this substance consists of.

SCHOENBERG.

SCHWENK and POSEY (33, **Restoration of the orbital socket**) advocate the method of Maxwell for the restoration of the lower cul-de-sac. This in brief consists of the dissection up of a crescentic flap of skin just below the lid margin except at its very center. The flap is passed under the lid margin and stitched to the two edges of an incision which has been made in the conjunctiva. The skin wound is then stitched together. In this way a skin cul-de-sac is formed. For the upper lid they employ the operation of Galovine by dissecting a flap from the temple and passing it under a bridge of skin near the outer canthus. Three cases are related.

ALLING.

X.—THE CONJUNCTIVA.

34. Cosmettatos, G. F. **Recurrent epithelioma of the bulbar conjunctiva. Death from metastasis.** *Annales d'oculistique*, clv., 1.

35. Eaton, F. B. **Scar-tissue conjunctivitis in animals. Its relation to insects and trachoma.** *American Journal of Ophthalmology*, February, 1919.

36. Musy, Th. **A case of tuberculosis of the conjunctiva caused by a tubercle bacillus of the bovine type.** *Annales d'oculistique*, clv., 3.

37. Verhoeff, F. H. **Observations on Parinaud's conjunctivitis.** *American Journal of Ophthalmology*, October, 1918.

Cosmettatos (34, **Recurrent epithelioma of the bulbar conjunctiva**) reports the case of a patient, thirty years of age, who presented a recurrent epithelioma with the following unusual features: It was located under the conjunctiva, it showed under the microscope a complete disorientation of the axis of mitosis, and it was very malignant. The patient died about one and a half years after the third removal of the growth from a tumor of the larynx.

Schoenberg.

A disease resembling trachoma, characterized by granulations and scar tissue in the conjunctiva, entropion, and corneal lesions, is known to occur in animals, especially horses, cattle, and dogs. Its relation to trachoma is uncertain. According to Eaton (35, **Scar-tissue conjunctivitis in animals**) there seems to be evidence that the transference of the disease is brought about through the agency of a certain species of biting horsefly. Cases have been observed in Illinois, Nevada, and California.

Alling.

Musy (36, **Tuberculosis of the conjunctiva caused by a tubercle bacillus of the bovine type**) caused a generalized tuberculosis in guinea pigs by injecting them with the material obtained from broken down cervical glands from a patient who had a clinically tuberculous conjunctivitis. An emulsion of the organs of these guinea pigs was injected in a young bull, which a few months later developed miliary tuberculosis. The evolution of the disease in this animal determined the strain of bacilli to be of the bovine type.

Schoenberg.

Verhoeff (37, **Parinaud's conjunctivitis**) defines this disease as a subacute conjunctivitis due to infection with a minute leptothrix and always associated with inflammatory enlargement of the preauricular and other regional glands. The source is unknown, but his cases have lent no support to the theory of animal origin. In some cases there is a history of trauma. The essential conjunctival lesions are focal areas of infiltration under the epithelium in various stages of necrosis. It is always unilateral and is never transmitted. It occurs most frequently in winter. To demonstrate the organism he uses a modified Gram stain. Inoculation of animals and attempts to obtain cultures were negative.

ALLING.

XI.—THE CORNEA.

38. STARK, H. H. **Congenital tumor of the cornea of doubtful classification.** *American Journal of Ophthalmology*, January, 1919.

39. WEEKERS, L. **Thermotherapy of corneal ulcers.** *Ibid.*, February, 1919.

40. WEEKS, J. E. **Disciform keratitis.** *Journal of the American Medical Association*, December 7, 1918.

STARK (38, **Congenital tumor of the cornea of doubtful classification**) describes a tumor of the cornea about 8*mm* in diameter and 5*mm* high bluntly conical in shape with a ring of clear cornea about it. He dissected it off and left the cornea apparently normal in thickness and transparency. The tumor consisted of fibrous tissue and fat cells covered by epithelium. There is a question as to whether it should be called a fibroma or a dermoid. No dermoid tissue as hair or sweat glands was present but these are not necessary to substantiate the diagnosis of dermoid in congenital tumors.

ALLING.

WEEKERS (39, **Thermotherapy of corneal ulcers**) adds his testimony to the usefulness of the application of heat without cauterization. He uses a red-hot electrode which he passes over the ulcer taking care not to touch the cornea. He claims that the results are excellent and that there is no unnecessary loss of tissue. He has experimented on the eyes of rabbits comparing the effects of cauterization and chauffage, proving the advantage of the latter as far as the integrity of the cornea is concerned. ALLING.

WEEKS (40, **Disciform keratitis**) after relating three cases of this rare disease and noting the local reaction to tuberculin, and the apparently favorable results of its therapeutic use, concludes that further observations may strengthen the view that the lesion is tuberculous in origin.

ALLING.

XII.—THE IRIS.

41. CALHOUN, E. P. **A consideration of the cause of heterochromia iridis, with special reference to a paralysis of the cervical sympathetic.** *Transactions American Ophthalmological Society*, 1918.

42. MULCAHY, T. A., and EWING, J. **Tuberculoma of the iris. Report of case with microscopic examination of the eyeball.** *American Journal of Ophthalmology*, November, 1918.

Whereas a small proportion of cases of dissimilarly colored irides are congenital CALHOUN (41, **Consideration of the cause of heterochromia iridis with special reference to a paralysis of the cervical sympathetic**) thinks that paralysis of the cervical sympathetic is responsible for a large percentage. This paralysis may be hereditary. He speaks also of a disease of unknown origin which begins usually in youth with a discolored iris, deposits on Descemet's membrane, and later cataract. It does not seem to be a true inflammatory process, but a type of vascular sclerosis. The author experimented upon rabbits and found appreciable changes in the color of the iris on the side of the complete excision of the superior cervical sympathetic ganglion.

ALLING.

The case of a child three years old is reported by MULCAHY and EWING (42, **Tuberculoma of the iris**). There was a yellowish white spherical mass about the size of a pea springing from the lower angle of the iris and extending to the pupillary edge. Two smaller tumors were also present in the angle above the larger mass. There was infiltration of the cornea over the larger tubercle, and the pupil was bound down by posterior synechiæ. The child had also enlarged phalanges. Four Wassermann tests were negative, but an injection of ¼ *mg* O. T. gave a constitutional reaction and increased circumcorneal congestion. Therapeutic injections of B. E. were started, but the child died of pneumonia complicating measles. At the autopsy the bronchial glands were found caseous and the fingers showed a granulomatous inflammation of the bone marrow and periosteum. The iris lesion consisted of infiltrations of lymphocytes, plasma cells, and blood-vessels. Tubercle bacilli could not be demonstrated.

ALLING.

XIII.—THE LENS.

43. LIEGARD. **The suture of the cornea in cataract operations.** *Annales d'oculistique*, clv., 1.

44. MAYNARD, LT. COL. F. P. **Intraocular hemorrhage after operation for glaucomatous cataract; recovery with useful sight.** *British Journal of Ophthalmology*, January, 1919.

45. ROURE. **How I should like to be operated on for a cataract.** *Annales d'oculistique*, clv., 3.

46. VERHOEFF, F. H. **Microscopic findings in a case of coralliform cataract, with remarks on congenital cataracts in general.** *Transactions American Ophthalmological Society*, 1918.

LIEGARD (43, **Suture of the cornea in cataract operations**) says that he sutures the limbus of the cornea after each cataract extraction. His method consists of introducing the suture horizontally through the parenchyma of the cornea, about half a millimeter below and parallel with the margin of the cornea. The suture is double armed and the other needle is passed through the scleral tissue just above and parallel with the corneal margin. A large loop of the thread is left so as to allow sufficient space for the knife to make the classical incision. After the cataract extraction is terminated the upper extremities of the thread are tied.

SCHOENBERG.

Useful sight after intraocular hemorrhage following operations for glaucoma and cataract may be said to be almost unknown. In MAYNARD'S (44, **Intraocular hemorrhage after operation for glaucomatous cataract; recovery with useful sight**) experience every example of this accident has resulted in blindness. Most surgeons enucleate the eye. The case recorded is a rare instance of recovery. A Mohammedan coachman, fifty years old, was operated upon for glaucomatous cataract. There were ciliary injection, shallow anterior chamber, steamy cornea, T. plus 2, ripe cataractous lens with good projection of light. The operation was performed under chloroform; cocaine and adrenaline being applied locally. The section was sclerocorneal with a large conjunctival flap; iridectomy-dialysis was performed, and after expression of the lens the anterior chamber was irrigated. Removal of some blood clots from the anterior chamber with iris forceps led to loss of vitreous.

The same evening, about six hours later, the dressings were found soaked with blood, and severe pain was experienced. The wound was bulging and the conjunctival sac was full of blood clots which were removed. The next day the dressings were soaked with blood, and for a week the wound bulged and serum oozed from it. The wound had healed ten days after the operation, but the pupil was occluded.

Five months later iridotomy was carried out and the resulting vision was $\frac{5}{40}$. The patient could see the eye of a needle with plus 16 D.

We suggest that in such cases it is wiser to reduce the tension by a preliminary iridectomy before proceeding to extraction.

T. HARRISON BUTLER.

ROURE (45, **How I should like to be operated on for a cataract**) recommends very warmly the inferior incision and iridectomy for cataract extraction. The advantages are that it is easier for the patient to look up, and for the operator to handle the instruments. In case of loss of vitreous the extraction of the lens with the spoon is very much easier. If cortex is left behind it settles in front of the coloboma so that the pupillary area remains clear. The author's experience with this method of extraction during the past three years has convinced him that a number of cases which went wrong when he used the superior incision would have been successful if the inferior incision had been used.

SCHOENBERG.

Although this peculiar form of cataract has been described, VERHOEFF'S (46, **Microscopic findings in a case of coralliform cataract**) case is the only one which has been examined microscopically. His patient was 39 years old and had first noticed failing vision at the age of ten. In each eye, ramifying outward from the anterior and posterior cortex were irregular crystalline formations, the remaining lens being clear. There was evidence of degenerative changes about the crystals showing vacuolization and fragmentation. The exact nature of the crystals is not known. Their insolubility in either excludes the possibility of their being cholesterine. Other reactions exclude hæmoglobin and all organic salts. The most plausible theory is that the crystals are protein which occurs in plants but which has never before been observed in animal tissue. They are probably produced by some metabolic change rather than by degeneration in the lens itself.

ALLING.

XIV.—SYMPATHETIC OPHTHALMIA.

47. ICHIKAWA, K. **Spindle-like formations in the inflamed uveal tissue of sympathetic ophthalmitis.** *American Journal of Ophthalmology*, January, 1919.

ICHIKAWA (47, **Spindle-like formations in the inflamed uveal tissue of sympathetic ophthalmitis**) describes a spindle-shaped body which he has found in five out of seven eyes enucleated for sympathetic ophthalmia and which he has never seen in eyes destroyed by any other form of inflammation. They occurred in intimate connection with eosinophile leucocytes. He is inclined to think that they may be formed by crystallization of the eosinophile granules and is quite positive that they are not artefacts. He does not assert that these bodies are of any importance in the etiology of sympathetic ophthalmia.

ALLING.

XV.—GLAUCOMA AND INTRAOCULAR TENSION.

48. MAGITOT, H. **Some traumatic variations of ocular tension.** *Annales d'oculistique*, cliv., 11.

49. MAGITOT, H. **Two types of modifications of ocular tension, traumatic in origin.** *Ibid.*, clv., 2.

50. MORAX, V. **Clinical observations on a few signs of atypical subacute glaucoma.** *Ibid.*, clv., 2.

MORAX (50, **Clinical observations on a few signs of atypical subacute glaucoma**) calls our attention to those cases of incipient, latent glaucoma complaining of troubles not mentioned in literature as belonging to the symptomatology of the disease. He reports the history of two patients, whose sole complaint was a pain in the orbit and face. Tonometry revealed marked increase of ocular tension, while the eyes were otherwise normal in every respect. Two other patients with apparently normal eyes complained of lacrimation, and their ocular tension was also found much above normal. All patients were relieved by the use of myotics.

SCHOENBERG.

MAGITOT (48, **Some traumatic variations of ocular tension**) reports a number of observations on patients with a disturbance of ophthalmotonus and draws the following conclusions: (1) The ocular tension depends upon and is regulated by the degree of fullness of the uveal blood-vessels. The angle of the anterior chamber and the aqueous have nothing to do with the ocular tension. (2) A distinction has to be made between the general and local ocular circulation. Under local circulation the author designates that which is constituted by the orbital arteries and veins and by the choroidal blood-vessels. Furthermore the local circulation is to be divided in two zones: the extraocular (containing the ciliary arteries and veins) and the intraocular zone (the uveal blood-vessels). The ocular tension is depending upon the local rather than upon the general circulation. The intrabulbar zone (the uveal blood sponge) constitutes the main factor regulating the intraocular pressure. The blood pressure in the uveal vessels is automatically controlled by the nervous elements scattered in the uvea; these elements belong to the sympathetic nervous system and regulate the amount of dilatation of the uveal blood-vessels independently of the general circulation. These nerve cells innervate the walls of the blood-vessels and receive two sets of fibers: constrictor and inhibitory. The constrictor fibers contract the blood-vessels; the inhibitory fibers produce a vasodilatation. He classifies the cases reported in two groups: those in which the lesion consisted of an inquiry or hemorrhage outside the eyeball, interfering with the return ocular circulation and thereby causing an increase of tension; and those in which the trauma had its greatest effect upon the eyeball itself. In some of these cases the tension was above, in other cases below normal. The explanation how a trauma of an eyeball may produce in some cases a hyper- in others a hypotension is given by the author in the following manner. Trauma may act as an excitant of the nervous elements of the uvea and a vasoconstriction with hypotension is the result; or it may paralyze the nervous elements, and vasodilatation with hypertension is the consequence. SCHOENBERG.

MAGITOT, H. (49, **Two types of modifications of ocular tension, traumatic in origin**) is convinced that the ocular tension is determined by the local circulation in the eyeball itself. He found that the modification of ocular tension, due to trauma, are of two distinct types: passive and active. In the passive types there is an increase of tension produced by other factors than those disturbing the nervous apparatus which acts automatically as the regulator of the ocular circulation and ocular tension. These factors are extraocular; they are to be sought in the orbital tissues, outside the eye, acting upon the veins (vorticose and orbital veins). The active type is produced by a functional disturbance of the neuro-autonomic regulator of the eyeball. This functional disturbance will cause a hyper- or hypotension according to what happens to the choroidal vessels: distension or spasm, excitation or a paralysis of the vasomotor elements. The author reports two cases illustrating these two types.

Case 1 regards that of a soldier 24 years old who after a severe fall was found to have a hæmatoma of both orbits and face and an ocular tension of 95*mm* (Schiotz). The tension dropped in jerky manner to normal during the following eight days. The interesting points about this history are that in spite of the high tension there was no disturbance of visual acuity or of retinal circulation; the field of vision was not contracted; the cornea was not hazy; the patient complained of no pain at any time and the pupils remained normal in size and reactions. The author thinks that this case is quite a flagrant contradiction to our current ideas about the pathogenesis of mydriasis, pains, and visual field contraction in glaucoma.

Case 2. A patient, 25 years old, with a small fracture of the left orbital margin gets an attack of subacute glaucoma of the left eye thirteen days after the accident. The tension, 80*mm* (Schiotz), responds promptly to pilocarpin by descending to 20*mm*, but raises again to 38*mm* when pilocarpin is discontinued and later on to 50–60*mm*. Finally after the use of adrenaline-cocaine drops it descends quite suddenly to and oscillates between 22 and 60*mm* (Schiotz). The tension always remained independent of the general blood pressure and as in Case 1 was always higher mornings than evenings. The author considers this case as an active type due to a commotional disturbance of the function of the neuro-autonomic apparatus, regulating the choroidal circulation. In this case, in contradistinction to Case 1, we find a paretic pupil, pains, and visual disturbance.

SCHOENBERG.

XVI.—THE RETINA AND VITREOUS.

51. DUNCAN, R. **Glioma of the retina with report of three cases treated with radium.** *American Journal of Ophthalmology*, October, 1918.

52. HARDY, W. F. **The vitreous and its replacement after loss.** *Transactions American Ophthalmological Society*, 1918.

53. JERVEY, J. W. **Hyperplastic exudative retinitis, non-hemorrhagic.** *Ibid.*, 1918.

DUNCAN (51, **Glioma of the retina**) cites three cases. and draws the following conclusions. All eyes with glioma should be enucleated at once and the orbit should be treated with radium to prevent recurrences. In recurrent cases radium offers the most effective method of treatment.

ALLING.

JERVEY (53, **Hyperplastic exudative retinitis**) uses four cases of organized retinal exudate as the basis for his thesis. In none of his cases was there any evidence of hemorrhage. He therefore suggests a clinical type to be designed by the title of his paper. He would include also retinitis circinata and retinitis proliferans of non-hemorrhagic origin as belonging to this category. The pathogenesis of his cases is evidently vascular and the tissue is analogous to granulation or chronic inflammatory tissue. Though not of this nature the lesions resemble those of syphilis, tuberculosis, or traumatic origin.

ALLING.

HARDY (52, **The vitreous and its replacement after loss**), experimented upon rabbits to prove the following propositions: (1) That the vitreous when lost is never regenerated as such. (2) That immediately after loss the vitreous is replaced by an albuminous fluid similar to the so-called emergency aqueous. (3) That the ciliary processes after vitreous loss show definite changes. These are thickening of the processes due to the engorgement of capillaries, an apparent lengthening of the convoluted formation so that the processes lie against the capsule of the lens and the formation of blisters—Greeff cysts.

The character of the fluid replacing the vitreous and the changes in the ciliary processes are evidently the result of the disturbed ratio between the intraocular and the endovascular tension—a product of disturbed physiology.

ALLING.

XVII.—THE OPTIC NERVE.

54. GOLDENBURG, M. **Tower skull with double optic atrophy.** *American Journal of Ophthalmology*, November, 1918.

55. ZENTMAYER, WM. **Concerning the ætiology of hereditary optic atrophy. Report of two cases with interesting X-ray findings.** *Transactions American Ophthalmological Society*, 1918.

GOLDENBURG'S (54, **Tower skull with double optic atrophy**) report is accompanied by Roentgenographs which show the skull of his case to be thickened irregularly with depressions on the inner table undoubtedly formed by the convolutions of the brain. The suture lines cannot be demonstrated but the grooves of the meningeal vessels are very marked. The findings lead to the conclusion that there was premature ossification causing internal hydrocephalus and increased intracranial pressure. The child when born had nasal obstruction, prominent eyes, and seemed to be blind. There were nystagmus and gray atrophy of the optic nerves.

ALLING.

ZENTMAYER (55, **Ætiology of hereditary optic atrophy**) relates the histories of two families in which this affection appeared.

The X-ray showed in each of the four affected members an enlarged pituitary fossa on the border line of the normal. He is of the opinion that our data are insufficient to draw definite conclusions as to the relation of the pituitary body to these cases.

ALLING.

XVIII.—ACCIDENTS, INJURIES, AND PARASITES.

56. CORIAT, M., and BOULAI, M. **A case of bilateral metastatic ophthalmia following a war injury.** *Archives d'ophtalmologie*, xxxvi., 3.

57. DOR. **Traumatic hemeralopia.** *Clinique ophtalmologique*, viii., 10.

58. DUVERGER, M. **A few symptoms peculiar to injuries of the posterior segment of the eyeball.** *Archives d'opthalmologie*, xxvi., 3.

59. Frenkel, H. **The syndrome of trauma of the anterior segment of the eye.** *Annales d'oculistique,* clv., 2.

60. Fromaget, H. **Remarks on an army service of oculo-orbital surgery.** *Archives d'ophtalmologie,* xxxvi., 3.

61. Hine, M. L. **The recovery of fields of vision in concussion injuries of the occipital cortex.** *British Journal of Ophthalmology,* January, 1919.

62. Terrien, F., and Cousin, G. **Prevention of war injuries of the eye by a new model of a mask.** *Archives d'ophtalmologie,* xxxvi., 3.

Captain Hine (61, **The recovery of fields of vision in concussion injuries of the occipital cortex**) records the results which he has obtained from the examination of five patients who had received concussion injuries during the war. The examinations were made in France at a Base Hospital. A bruising of the cerebral cortex has been taken to be the pathological basis of the clinical condition known as "concussion."

Three of the cases had definite fracture of the skull, and were seen at operation to have either subdural or extradural blood clot, the dura itself being intact. In two there was no demonstrable fracture of the skull although there were scalp wounds in the occipital region. A hand perimeter was used to examine the fields, and a ten millimeter white object was employed. When the condition of the patient allowed him to get up, smaller objects were used, and the Bjerrum screen was used to define the macular scotoma.

The following conclusions were suggested by the study of these cases—conclusions which agree with those come to by Colonel Lister, and Lt. Col. Gordon Holmes.

(1) In the case of an injury at or near the occipital pole the hemianopsia is frequently complete. There is not the tendency to macular escape which is noted in civil cases of hemianopsia.

(2) The visual fields are gradually restored by recovery from center to periphery. It may be noted that a scotoma produced by loss of cerebral substance contracts from periphery to center as the surrounding brain œdema subsides.

(3) The field of vision usually returns in the upper quadrant before the lower, and in Hines's experience never in the reverse sense. This is due to the fact that the injuries were all above the occipital pole. Hence the occipital cortex above the calcarine fissure, which represents the lower field of vision, has borne the brunt of the blow. An injury below the occipital

protuberance is much more likely to be fatal wooing to the proximity of the cerebellum and the medulla. For this reason it is rare to get a case which shows a superior quadratic macular defect.

(4) The restoration of vision is at first incomplete, but after it has commenced it proceeds in a definite order. Color perception comes after the appreciation of white even though the colored object be the larger. With the march of recovery smaller and smaller colored objects are recognized.

T. HARRISON BUTLER.

CORIAT and BOULAI (56, **Bilateral metastatic ophthalmia following a war injury**) report the history of a case in which septicæmia and endocarditis developed three months after an injury in the sacrolumbar region. Two weeks before death a metastatic ophthalmia appeared first in one eye, a few days later in the other.

SCHOENBERG.

DOR (57, **Traumatic hemeralopia**) has seen three cases of hemeralopia following trauma. The third case, reported in this paper, was that of a soldier who was struck on the head by the falling roof of a house that caved in. He sustained a fractured skull, and after recovering consciousness he was blind for about ten days. The blindness gradually disappeared and vision reached $\frac{2}{3}$ in each eye in the course of a month. The fundus, fields, and pupillary reflexes were normal, but the patient remained unable to see in the dark. The author raises the question whether hemeralopia can be produced by a lesion outside of the retina, in the optic fibers or the external geniculate ganglia.

SCHOENBERG.

DUVERGER (58, **A few symptoms peculiar to injuries of the posterior segment of the eyeball**) thinks that among the characteristic symptoms of a perforating injury of the eyeball, located behind the ciliary body, the most important for diagnosis is the peculiar appearance of the anterior chamber and of the iris. The loss of vitreous causes a receding of the lens, the anterior chamber becomes deeper, and the periphery of the iris appears to have undergone a bent of 90 degrees, so that it is in an antero-posterior instead of a facial plane. This appearance of the iris, together with a deepening of the anterior chamber and lack of iridodonesis, is more helpful to make the diagnosis than other symptoms, like the presence of the conjunctival loss of substance, of vitreous in the wound, immediate noninflammatory chemosis, and lower tension, because some or all of these may be absent while the appearance of the anterior chamber as described above is always present. A report of six cases illustrates the author's contention.

SCHOENBERG.

FROMAGET (60, **Remarks on an army service of oculo-orbital surgery**) relates his experience in a French hospital in which only soldiers with injuries of the eye and orbit were treated. The most difficult problem was the diagnosis and removal of intraocular foreign bodies, on account of lack of facilities for radiography. Besides, since the patient has to keep the injured eye quiet by fixing an object with his good eye, very often the radiography could not be done even when the means for this examination were obtainable. Finally Jaugea's method overcame this difficulty and radiograms gave very satisfactory results. The method consists of fixing on each extremity of the vertical meridian of the cornea of the injured eye a grain of lead. The eyes are closed and bandaged so as to keep them quiet and two radiographs are taken: one frontal and one lateral. A circle of 26*mm* diameter posteriorly and tangential to the two shadows of the grains of lead on radiogram gives a correct lateral projection of the eye. The frontal projection is obtained by uniting the two shadows by a line and drawing a circle through them using this line as a diameter.

SCHOENBERG.

FRENKEL (59, **The syndrome of trauma of the anterior segment of the eye**) enumerates the various symptoms and changes noticed by him in sixty-six cases of contusions of the anterior segment of the eyeball. He characterizes and classifies them in: (1) periocular injuries; (2) absence of corneal or scleral lesions; (3) subluxations of the lens with pupillary changes; (4) iridodialysis or rupture of the iris; (5) traumatic cataract (partial and stationary); (6) diminution of visual acuity out of proportion with the visible lesions.

SCHOENBERG.

TERRIEN, F., and COUSIN, G. (62, **Prevention of war injuries of the eye by a new model of a mask**) have found that very small particles of projectiles have caused complete loss of vision in 89 per cent. of eye injuries. They describe a new model of a mask made of metal which can protect very effectively the eyes and face from flying pieces of metal. The picture of this device should be seen in the original.

SCHOENBERG.

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ARCHIVES OF OPHTHALMOLOGY.

CONCERNING THE OCULAR PHENOMENA IN THE PSYCHONEUROSES OF WARFARE.[1]

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(*With six illustrations on Text-Plates XI. and XII. and one figure in the text.*)

THE opportunities for the observations on which this communication is based were afforded in France and England in the winter of 1917–18, and in this country in U. S. Army General Hospital No. 30, Plattsburg Barracks, in December, 1918.

It is not necessary to discuss in detail the confusion which has occurred by reason of the unfortunate application of the term "shell-shock." Because in the earlier years of the war many men who had been exposed to shell-fire, or had been in the near vicinity of exploding shells, developed in unusual degree a variety of nervous phenomena, these were attributed to the concussions resulting from the explosions, and the term "shell-shock" came into existence. Later all manner of nervous manifestations not specifically associated with what are ordinarily known as "peace-time neuroses" were classified under the same designation.

It is now well established by the studies of many expert observers that the majority of these cases are examples, to use an oft-recorded definition, of "peace-time neuroses with a war-time coloring,"[1] and the "neurosis is a maladjustment of the individual to his environment; his way of meeting a difficult situation." It must always be remembered, as Parsons points out, that the results of a true neurosis, be it one of war time or one of peace time, are not conscious or voluntary.

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[1] Paper read before the American Ophthalmological Society, June, 1919.

Such cases have been classified by various systematic writers. Pearce Bailey[2] makes the following divisions:

1. *Concussions*, the affected individual having acquired minute, disseminated lesions of the central nervous system. Some recover quickly; some do not recover, at least, not satisfactorily, and some pass over into a neurotic state—an implantation of a neurosis on an organic base. The percentage of those who develop symptoms indicative of true brain concussion is comparatively small.

2. *Neuroses of Neurasthenic or Psychasthenic Type*. These, as before noted, do not differ materially from the neuroses of civilian life. Some have symptoms suggesting endocrine disturbances. A certain number of cases develop as the result of intense physical exhaustion and recover quickly after rest.

3. *Hysterias*. These, if Babinski's conception of hysteria is accepted, represent conditions produced by suggestion and curable by psychotherapy.

Captain L. C. Frost[3] has proposed a more condensed classification, or grouping, to wit:

Group A. Shell concussion, to include such cases as present obvious physical lesions, or at least, such symptoms as may be assumed to interpret physical lesions. These comprise those individuals who have experienced concussions from exploding shells, the effects of atmospheric and gaseous compression, poisoning by carbon monoxid, etc.

Group B. Shell hysteria, psychoneurosis, and war shock, including those cases grouped in paragraphs 2 and 3 of the previously quoted classification. They should include those who, suffering temporarily from physical effects, recover from them, but acquire nervousness, or, as Captain Frost puts it, the transitory physical symptoms furnish not the cause but the starting point of the nervous phenomena—the affected individual becomes abnormally centered in the somatic symptoms.

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[1] F. W. Parsons, "War Neuroses," *Atlantic Monthly*, March, 1919.

[2] "War Neurosis, Shell-Shock, and Nervousness in Soldiers," *Journal A. M. A.*, vol. lxxi., p. 2148, 1918.

[3] *The Military Surgeon*, April, 1919, p. 350.

Disregarding the comparatively small group of "concussioned" cases with organic lesions, except in incidental mention, I shall attempt to describe some of the ocular phenomena which pertain to those who comprise the functional group, *i. e.*, those with psychoneurosis, war shock, and hysteria. It is admittedly difficult to make sharp distinctions; they readily become artificial. So also a definite classification of the ocular symptoms is not a satisfactory one. However, for convenience' sake, the conditions may be grouped as: (1) Various types of amblyopia and amaurosis, including disturbances of color vision, types which in civilian practice have been included under the terms "incomplete and complete anæsthesia of the visual sense." (2) Asthenopias and anomalies of accommodation. (3) Anomalies of the iris movements (pupil phenomena). (4) Anomalies of the eyelid and exterior eye-muscle movements. (5) Phenomena not included in the preceding groups.

1. *Amblyopia, Amaurosis, Achromatopsia, and Dyschromatopsia.* To this group belong reduction of visual acuteness, or its complete loss, disturbance of the color sense, and anomalies of the visual field.

(*a*) *Amblyopia and Amaurosis.* Ordinary reduction of visual power in hysteric patients is of no special importance, but the knowledge of a refractive error as it may have been reported, for example, by the examining officer at the time of the man's induction into the service, may readily furnish the suggestion which determines the symptoms of reduced acuteness of sight, for example, below the standard required in the army. Also the symptoms may be removed through the same channel.

Thus, a simple-minded recruit from the mountain regions of the southwest had been told by some traveling "eye doctor" during the period of his few months of "schooling" that his eyes were "weak" and "needed glasses." Bewildered by the strange surroundings of a training camp, backward in the acquisition of his duties, unmercifully "ragged" by his comrades, knowing that replacements for overseas work were being rapidly formed, dreading his in-

> feriority because of supposed "weak eyes," alarmed by cruel stories of the horrors of foreign warfare, he developed a typical neurosis, the prominent symptoms being tremor, whispering voice, and amblyopia, the visual acuteness being reduced to less than $\frac{1}{10}$ of normal. At first all attempts to improve the vision, although the eyes were perfectly healthy, were fruitless. The suggestion gently but insistently made that spectacles would restore the lost quota of sight and put him on an equality with those who possessed normal vision, with whom he would surely have to go, stimulated the instinct of self-preservation and vision became absolutely normal through glasses of negative refractive power. In the first instance he released himself from an intolerable situation by the development of a defect suggested by the eyes and in the second place relieved himself from an anticipated situation more intolerable than the first one by putting himself on equality with his comrades in the game of self-preservation, the restoration of vision suggesting the method of release.

Sometimes in place of a reduction of sight as tested with type-cards, the patient persists that the vision is "smoky," or "foggy"—"nothing has ever been clear since I was shell-shocked." This may be a temporary condition, but in some soldiers remained for a long time, that is, long after all other signs of "nervousness" had apparently passed away.

It is possible that in some instances there really is an ocular cause for the blurred or cloudy vision. Thus, Terrien[1] describes clouding of vision, which gradually ameliorates until there persist a diminution of visual acuteness and marked difficulty in fixing objects. He noted under these conditions retinal and papillary hypæremia, and suggests the possibility of retinal commotion as the cause of the foggy sight.

Referring now to complete, or practically complete, blindness among war neurotics, Kron's classification of bilateral hysterical amaurosis, as noted in civilian practice, made years ago,[2] may with propriety be retained with a few slight modifications: (*a*) Transitory forms lasting a few minutes; Auer has described transitory blindness lasting fifteen to twenty minutes, after a reprimand, fright under fire, or exposure to cold[1]; (*b*) short-enduring forms lasting for several hours to two weeks[2]; (*c*) long-enduring forms, lasting for months or even years.[3]

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[1] *Paris Méd.*, vol. v., Nos. 20, 31, September 25, 1915, pp. 338–349.

[2] *Neurologisches Centralblatt*, xxi., 1902, p. 584.

In general terms, the evolution of hysteric blindness, which may be more or less complete after a soldier is "shell-shocked" is as follows: During the period of being semiconscious, or dazed, he is partly or entirely blind; vision often returns with the restoration of consciousness, or it may persist for varying periods of time, as already described, if the soldier's attention is fixed upon, or directed to, his eyes. Thus, as previously pointed out, and as noted by A. F. Hurst,[4] an error of refraction by a process of auto-suggestion may perpetuate the loss of vision.

Associated with this psychic or hysteric cecity, there may be tonic blepharospasm, that is, a convulsive closure of the lids, or clonic blepharospasm, that is, continued blinking of the lids, sometimes designated "fluttering" or "twinkling" of the lids. If an effort is made to raise the lid a definite resistance is demonstrable; if the patient under command tries to open the eye, the only response is a trembling movement with no or only slight separation of the ciliary margins. On forcing open the lids the eyes are usually rotated upward and cannot be turned downward. The pupils react normally. The eyegrounds show no changes.

The symptoms of these neurotics, and therefore also the amblyopias, do not, to use Frost's words, "arise haphazard, and they are always the definite effect of a definite suggestion in some form." He quotes Colonel Salmon in this regard: "The symptoms exhibited usually bear a more direct relation to the existing psychological situation than they could possibly bear to the localization of a neurological injury. Thus, a soldier who bayonets an enemy in the face may develop an hysterical tic of his own facial muscles; hysterical blindness may follow particularly horrible sights, etc." A case recorded by F. W. Mott[1] illustrates this point. A shell burst near a man while he was attending to a wounded comrade. He dragged the wounded man into a culvert, but then found he was unable to see and had to be helped out. The emotional shock and the darkness of the culvert were responsible for the loss of visual function.

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[1] *Med. Record*, New York, lxxx., 1916, 641–644.

[2] Coutela has recorded loss of vision lasting four hours to two days, *Archives d'ophtalmologie*, vol. xxxv., No. 9, May–June, 1917, 539–556. This paper discusses visual disabilities the result of cranial commotion, and in those examples which arise in the absence of lesions he ascribes the major influence to "Hysterie Pithiatisme."

[3] Coutela, *loc. cit.;* F. Moreau, *Annales d'oculistique*, clvi., March, 1919, p. 156.

[4] *Medical Diseases of the War.*

The restoration of vision may be prompt or deliberate, as already stated. According to J. Herbert Parsons, the eye to recover last is often the "shooting eye." In some cases there is a prolonged period of dull or smoky vision, or when the acute blindness subsides defective vision may remain, dependent upon spasm of the ciliary muscle, the apparent myopia thus produced being correctible with concave glasses.

Hysterical amblyopia or amaurosis of the character now under consideration may be bilateral or unilateral. Eder[2] states that unilateral amblyopia is probably more common than double amblyopia. This has not been my own experience. In those cases personally investigated in all instances both eyes were affected, but not always to the same degree. It has been stated by Cruchet[3] that the first color seen by the patient on recovery from hysteric blindness is red. His observations were made in civilian practice. Whether a similar observation has been made among those suffering from war neuroses I do not know; personally I have no records in this regard.

Hurst maintains that the affected soldier does not move about like a blind man, but avoids hurting himself, though he does not relax the groping action of people with extremely defective sight. This observation was frequently made and commented upon by the earlier students of the visual phenomena of hysteria. In a word, the orientation of the affected individual is usually perfect. Various writers have in days gone by attempted a variety of explanations of this fact. Thus, it has been suggested that the peripheral visual impressions, although unperceived, bring about in the muscular apparatus, to use the language of Parinaud, those instinctive and unconscious movements by means of which we find our way through the external world. Groenouw states that hysteric patients with greatly contracted fields find no difficulty in getting about because the periphery of the retina still retains its power of perceiving large and bright objects. Wilbrand explains the phenomena by assuming that the irritability of the retinal periphery is not lost, and that the insufficiency of the retina is not so great when the patient is moving about as it is during steady fixation.

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[1] *Trans. Med. Soc.*, Lond., 1915–16, xxxix., pp. 157–226.

[2] *War Shock. The Psychoneuroses in War, Psychology, and Treatment*, London, 1917.

[3] *Archiv de neurologie*, 2 Series, xii., 1901.

Such lack of inconvenience from contracted vision is, however, not always evident, as, for example, in the following case, quoted also as representative of the enduring forms of hysteric blindness.

A colored soldier, aged 20, with a service of one year, part of which (from April, 1918, to November, 1918) was in France, while engaged in laying rails, began to complain of painful and inflamed eyes, which steadily grew worse as he was sent from one camp hospital to another, until finally he was returned to this country. There is no history of "shell-shock" in the ordinary sense of that term, but what may have been a slight conjunctivitis furnished the suggestion of an escape from an intolerable situation. The records state that his vision was respectively $\frac{6}{200}$ and $\frac{4}{200}$, but when I examined him in December, 1918, it was not nearly equivalent to that, being at best object perception, and that uncertainly. Except for a moderate clonic blepharospasm and the blindness, his eyes and eye movements were normal in all respects. The records state "he stumbled over objects placed before him." He exhibited an almost constant general tremor, was excessively nervous, "jumpy," to use a colloquial term. Called from the hall into the examining room, he came with the hesitating step of a blind person but failed to avoid objects in the room, and once walked into a small metal chair, which, striking the floor, made a crashing noise that sent him into a fit of trembling so violent that it simulated a general convulsive seizure. He was not a malingerer (he was closely watched for a long time), and suffered real mental distress. After one month of treatment by suggestion, aided with electricity, he made a complete recovery in all respects. The first visual field obtainable was extremely concentrically contracted, and day by day widened until it assumed a fully normal extent. His period of blindness, therefore, lasted approximately eight months. (Figs. 1–4.)

It is necessary to be thorough in the examination of the cause of the blindness, or of the defective vision, in some of these cases, for occasionally, although the general symptoms of neurosis are present, and the history of shell or other type of war shock is complete, the eye phenomena in so far as they pertain to sight are really due to ocular lesions. I have referred to the possible relation of commotio retinæ to this condition.

Laignel-Levastine and Courbon[1] describe the case of a soldier previously syphilitic who had been "shocked" sixteen months prior to examination, which was followed by stereotyped "blinking" of the lids, and who was practically blind—a blindness not due to malingering and not susceptible to improvement under the influence of suggestion—who had also external strabismus of the left eye and limitation of the exterior ocular movement in attempted rotations to the right, upward and in convergence. The pupils were small, but normal in reaction, and the papillæ showed only a slight departure from normal appearance. These changes and paresis of the ocular movements were attributed to meningitis; the blindness was not considered as an hysteric manifestation, although other symptoms of hysteria were clearly in evidence. Babinski, discussing this case, referred to observations of his own after cranial trauma, but also after "shell shock," where a diminished visual acuteness was noted ($\frac{4}{10} - \frac{2}{10}$ or lower), the papillæ being slightly hyperæmic and mellowed. The disturbance of visual function he considered to be out of proportion to the ophthalmoscopic findings (in some instances these were normal), and suggests that nerve-head changes are due to an organic disturbance of unknown origin.

As an example of the difficulty in deciding whether sudden loss of vision should be ascribed to hysteria, or rather to a psychoneurosis, or to an organic change, the following case may be recorded.

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[1] *Rev. Neurolog.*, i., 1916, vol. xxiv., p. 402.

> While crossing on a transport, a boy, aged 19, of good repute and on duty in "the eyes of the ship," on a raw, windy, and cold day went suddenly practically completely blind, and was examined a few hours later in the sick bay of the ship. Pupil reactions, ocular movements and eyegrounds were normal. Vision was reduced to the perception of a moving object held very close to his eyes, and only in a small space of each visual field down and in. For a day or two he had much headache. All tests for the detection of malingering were negative, and all efforts in this respect by careful watching day or night were without result. He had no tremor, was not apprehensive, at least did not manifest apprehension, although he must have heard the daily "abandon ship" bugle and the noise of the gun practice, and knew the vessel was in the danger zone. He was distinctly lacking in mental alertness, and would sit for hours at a time almost absolutely motionless. He stated that once before, following a blow on the head, he had been temporarily blind for some weeks. Examined by Lt.-Colonel Mosher, no otolaryngologic or sinus lesions could be found; the general examination was negative. Facilities for a Wassermann test were not at hand.
>
> The condition remained absolutely unchanged until about four or five days had expired, when a faint veiling of the nasal and upper edge of the optic disks was visible, an appearance not previously noted. On reaching Brest the patient was transferred to a French hospital, where every facility for examination was available. Through the courtesy of one of the naval officers, at the expiration of a month or six weeks a report was sent, which briefly summarized was this: In spite of a negative Wassermann, specific infection was suspected. Although he had had on board of ship a vigorous course of mercury by inunctions, the mercury was now administered hypodermically. Slowly, sight began to return; at the time of the report he could read large letters with one eye, and had a vision of about $\frac{10}{70}$ in the other eye. Since that time no record of the final result has been obtainable.

This case is mentioned because it would appear that what must have been a retrobulbar neuritis, at least in all probability, presented in many respects the signs of a long-enduring type of functional blindness.

Not long ago opportunity was afforded for the examination of a soldier who had seen overseas service, and who was sent to the hospital for the purpose of determining whether grossly defective vision of the right eye was dependent on a lesion, or was the result of a neurosis, and evidently the opinion had been formed that the neurotic element was predominant. In point of fact, however, careful focussing revealed a diminutive lesion in the macula, almost certainly a very small rupture of the choroid, and yet fairly expert examination prior to his advent in the army hospital on this side had failed to discover this lesion.

Lagrange[1] makes reference to soldiers with loss of central vision without visible lesions in the macula in association, for example, with bruises of the face, and insists that they must not be considered as malingerers, explaining the central scotoma by the existence of disorders which are not revealed to the ophthalmoscope. In like manner, it may be stated that some of the cases of greatly defective vision in patients who have been classified as "shell-shock" really had a physical basis for the loss of sight, and it behooves the examiner to be painfully conscientious in his examination before disregarding the possibility of organic ocular lesion, even in the presence of the general symptoms of a neurosis. There is, of course, no reason why the two should not be combined.

(*b*) *The Visual Field Phenomena.* Following the teachings of the Charcot School, it was for a long time definitely believed and stated that the essential characteristic of the visual field in hysteria is *concentric contraction*, which is evident at the beginning of the examination and is not produced by repeated measurement, and that the amount of reduction varies from a slight contraction to such extreme restriction that the most peripheral circle is just beyond the fixing point.

Sometimes the field was noted to have a *tubular character*—that is, the contracted visual field maintains the same size, no matter at what distance from the examined eye the point of fixation is placed. (Fig. 1).

A constantly recorded variation consisted in the fact that the red field was the last to be affected, with the result that its extent exceeds that of blue, and becomes the most peripheral of the color circles. Occasionally charts of visual fields were produced where red was noted to be the most peripheral color of the entire field. This is the so-called *inversion of the color field* (Figs. 5 and 6).

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[1] *Atlas d'ophtalmoscopie de Guerre*, 1918, p. 17.

As is well known, these visual field phenomena in hysteria are, according to Babinski, due to suggestion. If suggestion can be eliminated, he maintains they do not develop, and Morax, at first impressed as most observers were, with the significance of the retracted field of vision in hysteria, later adopted Babinski's views, and found that if suggestion was eliminated in the examination, this so-called hysteric contraction was not produced. Believing that it is impossible to avoid suggestion during ordinary perimetric examinations, he relies upon simpler methods, taking the field with the aid of outstretched fingers or other familiar objects.

Hurst and Symns[1] state that they have never seen patients with hysteric symptoms, apart from hysteric amblyopia, who spontaneously complained of disabilities resulting from a narrowed field of vision. When, however, the perimeter was used, the patient not infrequently described inconvenience on account of the limitation of his peripheral vision. Examination of numerous soldiers with various forms of war neuroses, all of whom were abnormally suggestible, never determined the presence of contraction of their visual fields until they were tested with the perimeter, which invariably resulted in the suggestion of a narrowed field, however carefully it was used. In the light of our present-day knowledge, there is no question that too great stress has been laid on concentric contraction of the visual field and inversion of the color lines as a stigma of hysteria, and I overemphasized these phenomena in my article on the Neuroses and Psychoses[2] written fourteen years ago, and endeavored to make distinctions between hysterias and neurasthenias based upon visual field examinations which were not justified, because I did not sufficiently realize, as many physicians at that time did not realize the potent influence of suggestion. None the less these examinations are interesting and valuable in the study of such cases from the very fact that they demonstrate, or help to demonstrate, the presence of an abnormal nervous mechanism, which permits the ready acceptance of suggestion.

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[1] *British Journal of Ophthalmology*, vol. iii., No. 1, January, 1919, pp. 17–21.

[2] *The Eye and Nervous System*, edited by Posey and Spiller, 1906, p. 614.

Hurst and Symns have made some very interesting observations on spiral fields among war neurotics. It will be remembered that von Reuss[1] described what he denominated the *fatigue spiral field*, which was thus produced. The first field having been already taken, the point at which the test-object in the second trial appears in the visual field on the horizontal meridian, for example, lies nearer to the center, and this is also the case in all meridians. When the examiner begins for the third time, the point of appearance of the test-object lies still nearer to the point of fixation, and so forth, until further contraction can no longer result and the later points of appearance of the test-objects coincide with the earlier ones. If all of these points are connected, a spiral line is formed which ultimately terminates in a closed line. Similar fields have also been described by Straub and Fuchs. Von Reuss was quite convinced that spirals were not more frequently observed because the search for them had not been an accurate one.

Writing on this subject, Hurst and Symns say: "If the examination was continued after the first field was marked out, a spiral field was always obtained, identical with that which has hitherto been regarded as a stigma of hysteria.[2] We believe that the reason why a spiral field of vision, which is the natural result of continued suggestion, has not been found in a larger proportion of hysteric cases, showing a narrowed field of vision, is simply because it has not been looked for, the examiner being content when he has marked the limit of vision a second time in each direction. It has generally been taught that a spiral field of vision is a result of fatigue, and it has even been stated that it is more frequently a symptom of neurasthenia than of hysteria. We have found that this is not the case, the inward spiral, which has hitherto alone been described, being a result of the method employed in using the perimeter. We have found that an outward spiral is always

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[1] *Das Gesichtsfeld bei functionellen Nervenleiden*, 1902.

[2] von Reuss was of the opinion that his spiral field was not especially an hysteric phenomenon, but belonged to the visual field abnormalities which could be developed in neurasthenic patients.

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ILLUSTRATING DR. G. E. DE SCHWEINITZ'S ARTICLE, "CONCERNING THE OCULAR PHENOMENA IN THE PSYCHONEUROSES OF WARFARE."

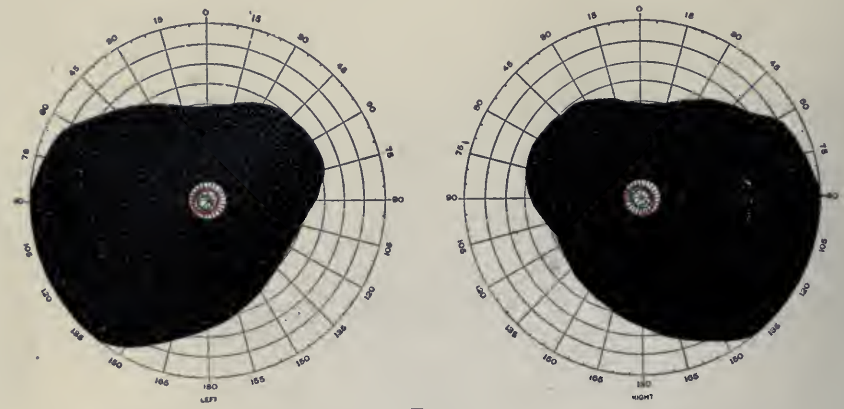

FIG. 1.

FIGS. 1 to 4. Hysterical amblyopia lasting eight months (see text). FIG. 1, typical tubular field. FIGS. 2–4 show gradual increase in size of field, easily brought about by suggestion.

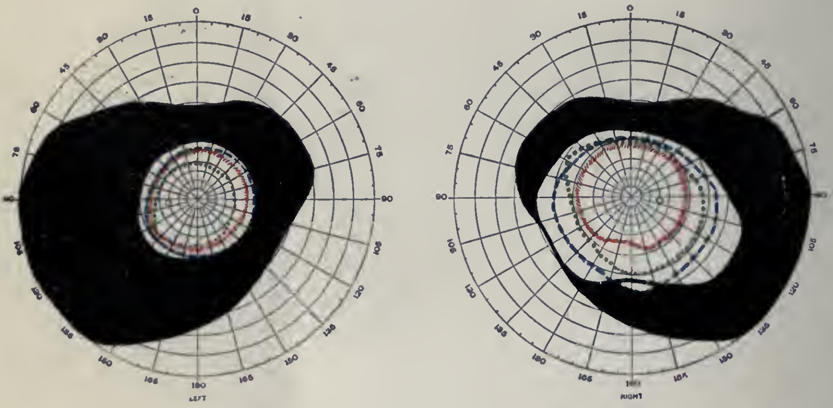

FIG. 2.

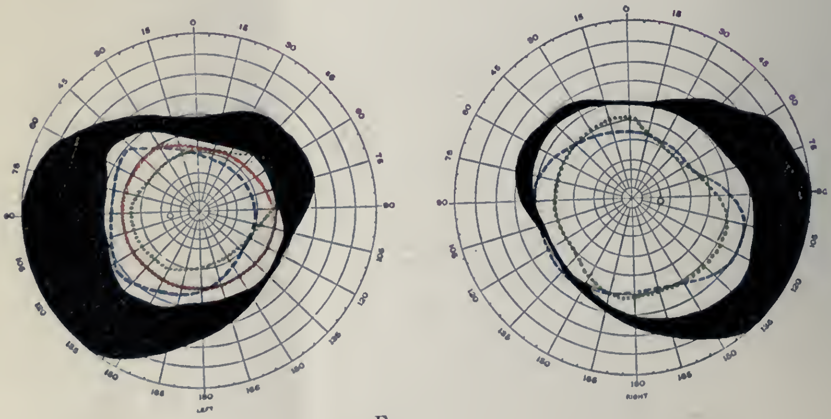

FIG. 3.

ILLUSTRATING DR. G. E. DE SCHWEINITZ'S ARTICLE "CONCERNING THE OCULAR PHENOMENA IN THE PSYCHONEUROSES OF WARFARE."

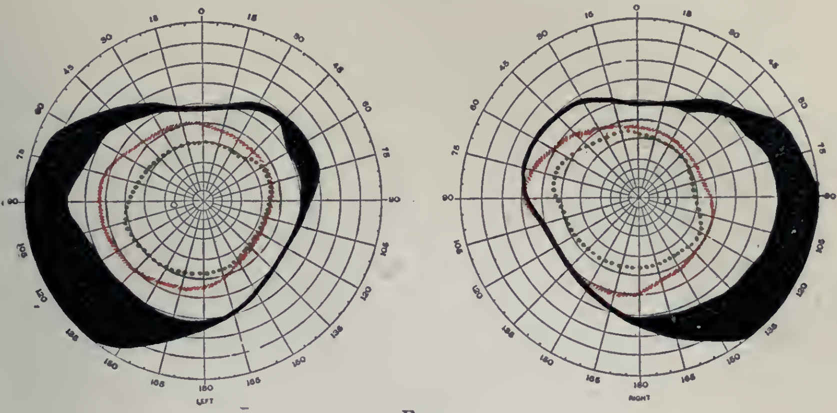

FIG. 4.

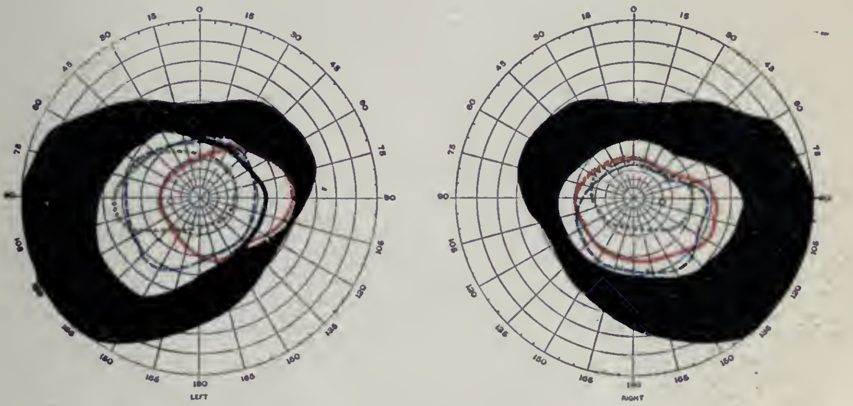

FIG. 5.
War shock and hysteria. Familiar contraction of field and partial inversion of color lines. Patient highly suggestible, V. $\frac{20}{L.}$

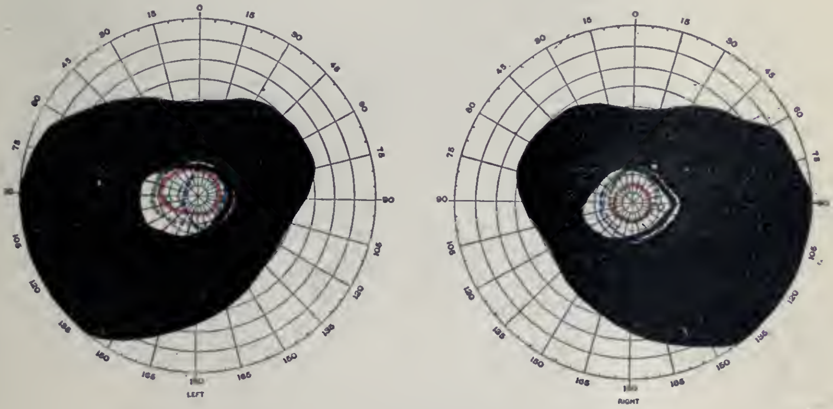

FIG. 6.
War shock and hysteria. Concentric contraction and color inversion. Note that red occupies in right field the smaller area. Patient highly suggestible.

obtained instead of an inward one if the white disk of the perimeter is moved outwards instead of inwards, as is commonly done. We have in this way even produced an inward spiral for one eye and an outward one for the other, or an inward spiral one day and an outward spiral another day, with the same eye" (Fig. 7).

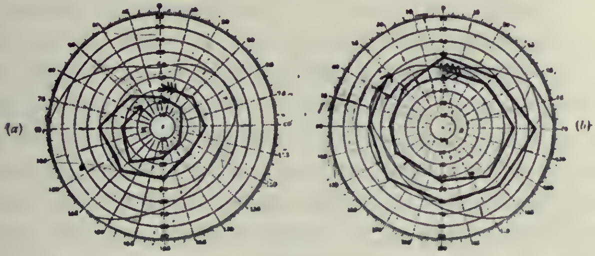

Fig. 7.

It would seem that the so-called tubular field as ordinarily described has been but little if at all mentioned in the description of the visual field symptomatology of war neurotics. That it is often present and may readily be developed there is no manner of doubt, and I have numerous observations in this regard. It has sometimes been stated that a tubular field is more nearly a characteristic visual phenomenon among hysterics than other departures from the normal field of vision, and yet when one thinks about it, it becomes apparent that it is more easily suggested than any of the other types of field which have been mentioned, and as shall presently be shown on some of the charts, a very much contracted tubular field may be the first development of what may be called the return of vision after hysteric blindness (Figs. 1–4).

In summary, then it may be stated that almost always among those who suffer from what has been called "shell-hysteria," or, in other words, the hysteria which resulted from various forms of war shock, concentric contraction of the visual field, with and without inversion of the color lines, tubular fields, and spiral fields, as described by Hurst, are commonly observed and readily suggested. In addition to these were other variations, particularly in the position of the color lines, although the fields themselves were not greatly contracted, and those types of fields, particularly in some of the psychasthenic cases which in civilian life have so often been developed during the examinations of those who in general terms are classified among the neurasthenics—fields that are often called the "retinal tire fields." It has not seemed wise or useful to attempt to distinguish between the field phenomena of those who appear to be purely hysteric and those who have developed a neurosis of the neurasthenic or psychasthenic type.

(*c*) *Color Blindness.* In addition to the chromatic aberrations in the visual field, classified under the general term of inversion of the color lines, a few cases of complete temporary loss of the color-sense have been recorded, therefore achromatopsias, and these without any material loss of form-sense, and associated with practically normal visual acuteness, as tested with type cards. An interesting case of this character is the following:

> A boy, aged eighteen, well educated, had the position of flag-boy on a transport, the duties of which he well and accurately performed. Suddenly one morning, when the ship was about entering the submarine zone, and the natural activities of ship life were exceedingly acute, he announced to the supervising officer that he was no longer able to distinguish the colors. It had been noted that he was apprehensive and restless for some little time before this announcement was made. He was immediately sent to the sick bay and examined. Functional testing of his eyes produced normal results in every respect, except that he was totally color blind. He was kept in the ward for a few days, and little by little apparently helped by reassuring statements which were made to him, not only in regard to the return of color perception, but to the safety of his position, his ability to recognize the colors returned and was ultimately entirely reëstablished.

Hysterical achromatopsia, using the term originally announced by Galezowski, is characterized by the patient's inability to distinguish any color, although he perfectly recognizes the outlines and shapes of objects. It has been well said, by whom I do not remember, that everything appears like a sketch in India ink. It has, moreover, been declared that although this hysteric color blindness may be complete, each color can be matched by a certain gray. In other words, the patient recognizes the equivalent gray tones, even more quickly than a normal individual. Such tests could not be made with the sailor whose symptoms have just been briefly described, nor am I able to state with accuracy the perception of which color he first acknowledged, but I think it was red, and this, if it is accurate, would correspond with the observation of Cruchet previously quoted.

When this boy was first examined it not unnaturally occurred to the observers that the temporary loss of color perception represented what has loosely been called "retinal exhaustion," but in the light of later experiences its explanation seems more likely to reside with that condition which is denominated an "anxiety reaction." Frederick W. Parsons,[1] referring to such reactions, writes: "Officers doubt their ability and worthiness to lead and have the responsibility of men. This is a transference of the emotion of fear for themselves to the possibility that injury may come to others." He refers to these cases as likely to prove stubborn, and not yielding to treatment as the gross hysteric symptoms do. The boy I have described had preceding his sudden loss of color perception a period of great anxiety, which increased as the transport entered, or was about to enter, the danger zone, and it seems not impossible that he overestimated his own responsibilities and feared that his duties improperly performed might bring the whole ship's company into great danger. The loss of color sensation, considering his occupation and his anxiety, was subconsciously adopted as the means to escape from the intolerable situation.

2. *Asthenopias and Anomalies of Accommodation.* Naturally many instances of prolonged asthenopia and weakness of the amplitude of accommodation have been observed, sometimes lasting for long periods and associated with foggy vision, as before described, especially if the subject has the background of an error of refraction, although this may be corrected. Spasm of the ciliary muscle producing a moderately high myopia, 4 D. or more, has been referred to, and this, as Morax and other observers have pointed out, may be the end-stage of

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[1] *Loc. cit.*

blindness, or rather, the patient recovering from the blindness, may pass into a stage of ciliary spasm, which can be corrected with a concave glass, or dissipated by the use of a mydriatic, and also is sometimes associated with extreme convergence of the globes. These phenomena differ in no sense from those frequently observed among hysterics and also among those who are classified as neurasthenics, as they are encountered in civilian practice.

3. *Anomalies of the Iris Movements* (*Pupil Phenomena*). Although usually, even among those who are temporarily blind as the result of various types of war neuroses, the reactions of the pupil are normal, sluggish response to light stimulus has been frequently noted. Guillain and Barré,[1] discussing the anomalies of the reactions of the pupils which have resulted from the commotion caused by the explosion of large projectiles without external wound, investigated twenty-six cases of so-called shell-shock. In some they found mydriasis, the pupils failing to react either to light or to accommodation. In some the pupils were unequal, and either on one side or the other, or on both sides, were irresponsive to light impulse. They also describe a true Argyll-Robertson pupil, and refer to the so-called paradoxical light reaction. While these pupillary abnormalities were often transitory, lasting from three to twenty days, the period of their existence was occasionally longer, but ultimately the anomalies disappeared. They further make reference to certain rare cases of very long duration. In one man fifteen months after the shock the pupils were still unequal and reacted only sluggishly to light. In another case one year after the shock, the reflexes were not well marked, and dilatation and marked hippus were noted.

It would seem from the description, especially as in six of their cases there was a xanthochromatic cerebrospinal fluid, that there must have been cerebral hemorrhage, and the authors suggest that some of the pupillary phenomena may have been due to the products of hæmolysis or the presence of clots at the base of the brain. They also suggest retinal commotion as a possible cause, and even commotion of the ciliary nerves under the influence of the explosive shock. It will therefore be seen that these pupillary phenomena do not belong, except perhaps those in which there was a temporary sluggish reaction, to the symptoms of a neurosis, or, in other words, that they had a very definite physical basis for their development. Such, too, must have been the explanation of the pupillary immobility and abolition of accommodation and convergence which has been described by Bergyl, and which he himself ascribes to the result of a cerebral concussion.

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[1] *Bull. Acad. de Méd.*, par., 1917, i., xxviii., pp. 158–159.

4. *Anomalies of the Eyelid and Exterior Eye-Muscle Movements.* As is well known, in the studies of hysteria in civilian life mention is usually made of a certain number of cases of so-called hysterical palsies of the ocular muscles, which Binswanger maintained indicated a defect of the associated lateral movements, or a motor insufficiency of certain muscular movements closely connected with psychical processes. It would seem, if they occur at all, that there is an apparent paralysis of movement and not of the muscle supplied by a given nerve. In those cases of so-called shell-shock coming under my own observation I never noted any phenomena which would belong to this group.

Extreme convergence of the visual axes in association with spasm of accommodation has been mentioned. Descomps, Enzière, and Mère[1] describe a convergence of the eyeballs immediately after rotary tests have been made in individuals who have been shell-shocked; one eye may converge more than the other. The convergence lasts from eight to sixty seconds. They also speak of functional or organic palsies of the eyes. No explanation of these phenomena is given.

True nystagmus must have been exceedingly rare.[2] Very frequently nystagmoid movements could be developed in forced rotation of the eyes in the lateral directions. A curious speech defect was evident in many of the war neurotics, not exactly a stuttering, but a repetition of a single word, or brief sentence; for example, the soldier would say: "I was shocked, I was shocked, I was shocked, I was shocked, in the, in the, in the, in the, Argonne." Sometimes these repetitions were many in number, half a dozen or more, before the final word of the sentence was reached. Almost always there was an associated trembling of the lips and general tremor, and almost invariably, if these patients were made to turn their eyes sharply to the right or left, a jerking nystagmic movement was developed. In other words, it was a species of tremor.

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[1] *Bull. et mem. soc. méd. des hôp. de Par.*, March, 1918, pp. 385–389.

[2] J. Mitchell Clark, *Bristol M. Chir. J.*, 1916, xxxiv., 49–72; also Ruossy and Lhermith, *The Psychoneuroses of War*, London, 1918, edited by Turner.

Moreau[1] has written a paper on cases of nystagmus in concussion. In one case, for example, the soldier was shocked by the explosion of a large shell; coma followed; there was no external wound. Nystagmus resulted, the oscillations varying from 100 to 140 a minute. In another case, in addition to the nystagmus (the patient had been buried by the explosion of a shell, although there was no wound), he also had marked clouding of vision. The nystagmus appeared immediately after the trauma and had not changed. No other ocular defects were found. He does not attempt to give an explanation of the phenomena.

Of the eyelid peculiarities, blepharospasm, already referred to, was most common, sometimes clonic and sometimes tonic, and often in association with gross visual defects, as well as photophobia, this photophobia usually associated with a mild conjunctivitis, especially if at the time of the accident sand or smoke, or other irritating agent, had gotten into the eyes. The combination of photophobia, blepharospasm, with ciliary spasm, amblyopia and contracted fields, Coutela[2] denominates the "syndrome commotionel oculaire."

5. Exophthalmos has been noted among the war neurotics. In one case I observed the condition was marked, steadily increased for a few days, and the soldier's gait resembled that of cerebellar ataxia. Babonne and Celos[3] report two cases of mild exophthalmic goiter, which developed shortly after shell-shock. In one there was definite exophthalmos, in the other it was only slightly present, and nystagmic movements appeared in extreme rotations of the eyes.

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[1] *Ann. d'ocul.*, Paris, 1918, clv., p. 233.

[2] *Loc. cit.*

[3] *Bull. et mém. de la soc. méd. des hôp. de Par.*, xxxiii., No. 19–20, June 1, 1917.

Lortat-Jacob and Hallez[1] have recorded the case history of a young soldier, who suffered from shell-shock without external injury. After an initial asthenopia, he developed about five weeks after the shock a pure paralysis of the left sympathetic—left miosis, narrowed palpebral fissure, enophthalmos, and false ptosis. The fields and eyegrounds were normal. X-ray of the cervico-dorsal region was negative. Although organic cause for this condition was not discovered, it is difficult to believe it did not exist.

A word may be said in regard to the physical characteristics of the patients who suffered from so-called shell-shock, remembering that shell-shock is now used as equivalent to a neurosis, because many of the subjects never heard the sound of a bursting shell, but none the less had all of the symptoms of those who had been exposed to concussion from this influence, although they were not themselves wounded. It is well known, to use the words of an eminent neurologist, that the neuropathy which we term hysteria is expressive of a biologic inferiority, and in many studies that have been made among the subjects of the war neuroses the majority of the patients have shown a neuropathic tendency or inheritance. Moreover, it was often possible to obtain a neurotic family history, including insanity, epilepsy, alcoholism, and general nervousness, and the neuropathic constitution of the patient himself was frequently demonstrated. All this side of the question has been elaborately discussed by many neurologists both here and abroad, and an excellent paper on this subject has been written in our own country by Dr. Francis X. Dercum.[2]

It is evident that these war neuroses do not differ from the peace neuroses in their symptoms and evolution except in the association of the war coloring. The paper has not been burdened with long case histories, but the charts of vision may be interesting, and represent studies that were made in the U. S. General Hospital No. 30, at Plattsburg Barracks, and for the charts and help in this regard I am indebted to Captain Julius Newgord, Chief of the Eye, Ear, Nose, and Throat Department of that hospital. Only a few of the numerous fields which have been charted are reproduced. Others are similar and represent various types of visual field disturbance which have been referred to in the paper.

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[1] *Bull. et mém. soc. méd. des hôp. de Par.*, 1918, 3 s., xlii., pp. 311–314.

[2] *Archives of Neurology and Psychiatry*, 1919, vol. i., pp. 65–76.

FURTHER EXPERIENCE IN THE OCULAR FUNCTIONS OF AVIATORS.[1]

By Colonel W. H. WILMER, M.D., M.C., U. S. A. (Discharged),
Washington, D. C.

INCREASED experience in the Air Service in France deepens the conviction that the original ocular requirements for entrance into the Aviation Corps of the United States are none too strict, even though they do demand a standard of normality. History in all activities of life is replete with tributes to the "masters of fate"—those who have "made good" in spite of, or by reason of, physical handicaps. Such men have one's deepest admiration; but their forte, as a rule, is not in the air.

One of my early experiences in the A. E. F. was sitting on an accident board convened to consider the cause of death of two pilots from a collision in the air. The evidence brought out the fact that the student responsible for the accident had been disqualified in the United States on account of imperfect sight. In training he had passed through several fields until he reached the one where acrobatics were taught. The other pilot, an excellent flier, was just finishing his turn and was coming out of a vrille preparatory to landing. By virtue of the rules of the field and his "dead stick" he had the right of way, but the student with poor sight ran into him without seeing him and both were killed.

The great advance in the airplane, the increase of speed, facility of acrobatics, height of "ceiling," and the diversified duties of the flier have led to marked specialization in the air.

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[1] Read before the American Ophthalmological Society, June, 1919.

Before considering the ocular requirements of the aviator it might be well to speak of the fast-shifting types of air work that existed when the armistice was signed.

Types of Fliers.—The day chasse, or scout, pilot is the type of flier which is always suggested to the public mind when the word "aviator" is used. He is the "birdman" and the "hawkman" of the press. His duties are various. He must fly to any height, changing altitude instantaneously. It is his duty to protect his own bombers and observers on their special missions. Lieutenant Rath aptly calls him the "mine sweeper" of the air. His altitude varies from "ground strafing" to the limit of the plane's ability to climb. He has to keep a sharp lookout in the skies and in all points of the compass for friendly or hostile planes. A spot in the sun neglected may develop into a plane to be fought.

The night chasse pilots, so far, have not proved to be of great military value. While pursuing the enemy, they were often shot down by their own barrage, as instanced by the last air raid upon Paris when many French machines were lost.

The observer is of such importance that Colonel Reille, the able French artillery officer, says: "The principal rôle of aviation is not in dropping bombs, but in observation. The flying machine should not be considered so much as one of the arms of the artillery as one of its eyes—and that eye the better one. The bringing down the enemy's plane blinds his artillery." Richthofen, the German flier, says in his book: "Frequently a photographic plate is more valuable than shooting down a squadron." This type of flying officer is fast developing into a skilled specialist in artillery and infantry liaison with highly technical knowledge of radio, the making and interpreting of maps and photographs, visual reconnaissance with reports, and aerial gunnery. His work carries him to all altitudes, from dropping a message at 300 meters to a long reconnaissance at 6000 meters. In spite of all that must be seen on the ground, when he is near the enemy's line, he can spend only one eighth of his time for this work—the rest of his time must be spent in looking for planes in the air.

Day bombing has been described by Lieutenant Rath as "artillery on wings." The objectives are in the immediate rear of the enemy's lines, zone of activity, and strategic points far within the enemy's country. These distant flights are frequently of four to five hours' duration, and often at an altitude of over 4000 meters, to avoid the enemy's anti-aircraft guns. The targets are often large and well mapped out before leaving the aerodrome. But the bomber must be minutely familiar with the topography of all the country embraced in his mission. Likewise, he must be able to use his maps intelligently. One of our fliers working with the English told of an amusing incident of a very successful night bomber who, on a very beautiful day, went up for a "joy ride" and got lost. He was not accustomed to the topography in daylight.

The night bomber seldom flies higher than 2000 to 3000 meters, but he must be thoroughly familiar with every foot of ground back of his own lines in order to make a landing without really seeing, should that necessity arise. He must be familiar with the topography of the hostile country in order to recognize guiding landmarks. He must be able to recognize all roads, rivers, woods, vineyards, and towns, the last largely by their geometric formations. He must know the constellations and their positions on the compass. Moreover, he must constantly consult his maps and compass. The following contretemps, due to unfamiliarity with the section, is told by some French fliers: An expedition actually bombed Nancy instead of Metz, and finally capped the climax by landing in Luxemburg! Many night fliers have spoken of the very confusing effect of moonlight on the earth-mists, which are so common in France during certain seasons. All Allied fliers speak of the greater effectiveness of the enemy's searchlights, which leave one blinded for a long time.

The aerial gunner's work has now been taken over by the observer, who has added the use of the machine gun to his other duties.

The aerial navigator is a late product of the war evolved by the necessity of flying in foggy or rainy weather and at night. He directs the flight of his pilot by map and compass. So far there are very few thoroughly trained aerial navigators.

The ferry pilot flies the machine from a central station to some aerodrome near the front, so he does not have to consider the questions of combat or of altitude. In the British service the ferry pilot usually flew the planes across the Channel.

In the lighter-than-air ship the altitude is usually not over 300 meters, and the landing does not require the fine adjustment of sight and judgment of distance.

In the captive balloon the height is usually not over 2000 meters; and while good sight is of great value, the observer has little responsibility in landing, even when he has to take to his parachute. In the free balloon, however, the finest ocular adjustments are necessary.

In regard to sea planes, Major McCombs, who has had much experience in the matter, feels that the pilot should have good muscle balance, stereoscopic vision, and night sight. He says: "The level of the water is difficult to judge, especially when the weather is very calm, and at night." The "ships" are slow to answer the controls, and heterophoria is a common cause of bad landings.

General Considerations.—Color plays a most important part in the success of all types of fliers. On all maps generally used by observers, the woods are green, rivers blue, roads yellow, railroads black, and towns brown. These maps are used for spotting important objects. Sky rockets, with a parachute, are white, red, or green. And cartridges, with and without parachutes, are of similar colors. Bengal flares, which are used in woods and heavy underbrush, are red and white. The aerodromes use red and green or white lights for homecoming planes, while the planes themselves carry a red light on the port and a green light on the starboard side. In a "dog fight" fliers of great experience state it is necessary to recognize the colors on a machine in order to avoid the possibility of shooting down a friend. In artillery work the sense of color is necessary to detect false roads, trenches, and guns which have been camouflaged by colored screens, trees, etc. Infantry contact is one of the most trying pieces of work that an aviator is called upon to do. He must be able to recognize, in addition to everything else, the colors of the various uniforms. An observer tells of a pilot who flew three times over a body of troops before he felt it safe for the machine gun to be used. He had poor color vision, and his final decision was made only when he recognized the enemy helmets. All types of fliers over land are liable to have to select quickly a place for a forced landing. In this connection Captain S. J. Allen, R. A. F., states that good color vision is necessary to detect differences of color on the ground. A light field indicates stubble; a dark-green field, grass, or wet and marshy ground; dark-green stripes running across fields, water or ditches; yellow, sand; and rough brown spots, bumps.

Sight.—The value of good sight is very tersely expressed by one of our very successful fliers at the front: "Men with poor vision do not come back." Major McCudden, R. F. C., graphically describes the unseeing pilot: "I shall never forget how that Fokker looked on the 2 C's tail, while the British pilot, calmly flying straight, not looking behind him at all, was no doubt thinking of Blighty, home, and beauty." The increase of vision by practice is emphasized by an American Ace: "I twisted my neck about so continuously, searching the sky for enemy planes, that the muscles of my neck have become enlarged. Although my sight has always been perfect, I improved very markedly my power of being able to quickly pick up the sight of a plane." While visual acuity is a most valuable asset to every type of flier, it is of less importance, relatively, to the day bomber, to the night bomber, and to the aerial navigator. In the case of the former, the targets are large; with the second, rod vision is more important than that of the cones; in the third type, glasses could be worn with comparative safety.

Should some ocular error become manifest in a pilot who is good otherwise, the error should be carefully corrected, preferably having the correction ground in his goggles. The pilot should, however, be carefully advised of the facts that the goggles might be blown off, be broken, or become fogged or soiled with oil or water.

One-Eyed Men.—All experienced men with whom I have talked agree that a one-eyed man should not be admitted into the Aviation Corps. However, when a successful combat pilot loses an eye, the question becomes an important military one, and the matter is now under consideration by the British Research Committee. The objections to returning him to duty are based upon the facts of a diminished field of vision, and the impairment of the ability to judge speed and distance which causes difficulty in landing. The visual field is of lesser importance, owing to the nature of the work (most aptly described "rubber neck") which keeps one moving his head in all directions in search of planes. The difficulty in landing is more serious. It is recognized that some men cannot be trained to use one eye. On the other hand, a number of one-eyed pilots in the British Service were salvaged for their country. However, the gradual returning ability to take off and to land could be tested with a fast ship at the aerodrome. Professor Rivers, of the British Research Committee, in a personal conversation, laid great stress upon the economic value of the training, judgment, and experience in seeing of the combat pilot. According to a British authority, one R. F. C. cadet out of four reached the air over the enemy's line. In our service approximately one half of the observers and one third of the pilots got to the front.

The first few trips over the line are the critical ones. Other considerations are: the length of time it requires to make an aviator, that all good fliers are not good in combat, and that an aviator with perfect sight has to learn to use it understandingly.

Captain Rickenbacker, the foremost American Ace, telling of his first trip over the enemy's lines, says: "Major Luftberry asked what had been seen; but we both repeated, as easily as we could, that we hadn't seen any other aeroplane in the sky. 'Well,' said Luftberry, 'one formation of five Spads crossed under us before we passed the lines and another went by about fifteen minutes later and you didn't see them, although neither of them was more than five hundred yards away!'"

Color Vision.—The various activities in which the recognition of colors plays an important part have been mentioned. It is of great help in following the topography of the country in all types of fliers. However, if a successful color-blind pilot is discovered in classification, he could be used as an instructor, ferry pilot, or a night bomber, if only white lights were used at his aerodrome. Major McAlester, who was for a while stationed at the observers' school at the Second A. I. C., recommends very strongly the necessity of taking the color fields as well as the central color sense.

Muscle Balance.—Good muscle balance has been considered of great importance by those who have thoroughly studied the subject. Halben, in 1914, laid emphasis upon the danger of the laming of an eye muscle, thus producing a false projection and a disturbance of orientation. That the great importance of good muscle balance has been recognized is shown by the fact that a school of heterophoria has been established in England under the supervision of Major Clements. Here many pilots who have been unsuccessful in training have been salvaged by his painstaking work. During the period from August, 1917, to July, 1918, 84.5 per cent. of the officers turned down for bad landing were successfully treated by training the ocular muscles. In two subsequent groups 50 per cent. were successfully treated in one group, and 92.8 per cent. in the other. For ocular training Major Clements uses largely the Worth Amblyoscope. The importance of this subject in our service has been emphasized in the ophthalmologic departments of the medical research laboratories in this country and in France. In addition to well-balanced muscles, strong convergence, and accommodation, we have felt the necessity for measuring the rapidity of accommodation in changing the point of fixation, and for comparing the records of the two eyes. At the last meeting of this Society Professor Ferree read a most valuable paper upon "The Inertia of Adjustment of the Eye for Clear Seeing at Different Distances." Major Berens has done much work upon an apparatus to make these tests, and also upon other instruments for studying monocular and binocular parallax in the judgment of speed and distance. Treatment of these muscular weaknesses consists in removing all underlying causes, in rest, in muscle exercises, and, in rare instances, in operative procedures. The wearing of prisms is risky.

Stereopsis.—The value of stereoscopic vision has been questioned, owing to the recognized fact of the predominant eye, and the fact that a few men with one eye, and some with poor stereoscopic sight, have been successful fliers. However, in our opinion, good stereoscopic vision is of great value in the judgment of distance in making a landing. It is also of value in studying stereoscopic plates. The cards with stereoscope as used in the selection of the flier take up very little space and they are easily and quickly used. However, the most practical test that I have seen is the one used by Professor Spearman. In brief, it consists of two fixed vertical outside wires, a middle movable wire attached to a millimeter scale. This wire is attached to an endless cord running over a pulley at either end. The background is a milk glass lighted by electricity that can be increased or diminished. The observer sits facing the wires at a distance of ten feet. He looks through an aperture and moves the central wire back and forth until it seems to be on the same line with the two outside wires. He is allowed twenty seconds to make each reading, and his average is taken from six readings. His accuracy is recorded on the millimeter scale. The method of making this test can be improved by making shorter the period allowed for observation, by reducing the twenty seconds to from two to five seconds. In Professor Spearman's latest apparatus, the comparative test objects are formed by the edges of two pieces of milk glass set at an angle. Professor Spearman has found correlation between success in flying and good stereoscopic vision taken by this test.

Retinal Sensitivity.—Study of the various methods of testing retinal sensitivity impresses one with the fact that no "short cut" to accurately testing this function has been devised. Our Italian allies use a very good test of the contrast sensibility. The test-object is a series of incomplete circles of different sizes on a background in which there is an increasing diminution in the shade difference between the circles and the background. There are a number of more accurate tests, but they require from one to one and one half hours for each subject. Professor Spearman has a new apparatus. He first produces a uniform bright adaptation by having the subject face a white screen illuminated by a 1000-watt lamp. He is then kept in complete darkness for two minutes before the testing begins. He then tests the threshold sensitivity by throwing different stimuli upon the screen with his "night vision box." At the Medical Research Laboratory, Mineola, L. I., Captain Cobb has devised an excellent "adaptometer" which he has described in full. He points out facts that have already much impressed us when considering the classification of the night flier, and our want of exact knowledge concerning the photometric value of objects to which he is exposed. One has to consider the varying light value of stars, clear moonlight, misty moonlight, reflections from roads, rivers, towns, and the "blinding" effect from tracer bullets, lights at aerodromes, sky-rockets, cartridges, flares, bursting shells, and searchlights. Practically, it would seem that one who has a good average speed of adaptation with an average recovery from exposure to light for a brief period would make a safe night flier, from the visual standpoint. An accurate test of this type requires an hour or more, but in classification of fliers for night work it is well worth this expenditure of time and care. McCudden, speaking of a pilot flying at night, says: "He left the ground in the dark to fly twenty miles across France to an aerodrome, and as soon as he was off the ground he flew through the side of a house. The only thing that was undamaged was himself."

Simple visual reaction time, which is so important to the acrobatic flier, is not of so much importance to the combat pilot unless associated with cool decision and accurate muscular coördination. Richthofen, who was credited with bringing down eighty Allied fliers, says in his work, *The Red Battle Flier*: "It followed that the victory would accrue to him who was calmest, who shot best, and who had the clearest brain in a moment of danger. We have lost many good fighting pilots through their getting excited and dashing headlong into an unequal combat." The most successful fighter is not the one who fires the first shot, but the one who carefully lines up his sights upon the enemy and who downs him with the first bursts from his machine gun. In other types of fliers a strong physique is more important than a rapid reaction time, on account of the physical strain to which they are exposed. The French authorities give the average visual reaction time as $\frac{19}{100}$ seconds. The average of these tests made in the laboratory in France with the d'Arsonval chronoscope is: students, $\frac{19}{100}$; monitors, $\frac{17}{100}$; testers (among whom there were some remarkable stunt fliers), $\frac{18}{100}$; American fliers from the front, $\frac{20}{100}$ and French fliers, $\frac{21}{100}$.

CONCLUSIONS.

1. Absolute normality of the eyes is one of the greatest physical assets that a flier can possess.

2. Affections of only passing inconvenience on the ground are serious in the air, such as scintillating scotoma, muscæ volitantes, photophobia, epiphora, heterophoria, and for the night flier, poor dark-adaptation.

3. A successful combat pilot with trained air vision who loses one eye may, during the exigency of war, be seriously considered for a return to flying status, under certain conditions previously mentioned. This, however, should be considered only when the confidence is unimpaired and there is keenness to get back.

4. In classification, a cycloplegic should be used and the fields for form and color taken and recorded.

5. The regular eye reëxamination of the flying officer should be made every two months, at least.

6. The simple visual reaction time is of great value to the chasse pilot if associated with cool determination and caution.

In spite of the painstaking work of our Allies and of our own laboratories and the splendid record of this work, should a questionnaire be framed asking what was the most important lesson learned in the A. E. F. concerning the ocular problems of aviation, I would answer, "How much there is to learn and how little is known!"

A CASE OF KERATITIS PROFUNDA (OR DISCIFORMIS?) WITH MICROSCOPIC EXAMINATION.[1]

By F. H. VERHOEFF, M.D.

(From the Massachusetts Charitable Eye and Ear Infirmary.)

(*With two illustrations on Text-Plate XIII.*)

ALTHOUGH it is possibly somewhat uncertain whether the case I have to report should be classified as one of keratitis profunda or of keratitis disciformis, our knowledge regarding the true nature of either of these conditions is so indefinite that the histological findings in my case would seem to be of considerable importance. The case occurred at the Massachusetts Charitable Eye and Ear Infirmary on the service of Dr. F. M. Spalding to whom I am indebted for the privilege of reporting its clinical features.

> CASE.—Benjamin, H. N., aged 65, stableman. Admitted to the Massachusetts Charitable Eye and Ear Infirmary, January 2, 1915. The patient states that his left eye has been affected for the past three weeks. The vision has become blurred, and the eye has felt irritated, but there has been no actual pain.
>
> *Examination.*—Right eye normal, vision $\frac{20}{30}$, tension 17*mm* (Schiotz). The left eye is considerably congested. The cornea is markedly hyperæsthetic, has a distinctly grayish hazy appearance, with general unevenness of the surface, probably due to œdema, but it does not stain with fluorescin. The anterior chamber is normal in depth. The pupil, normal in size, reacts poorly to light. The iris markings are slightly blurred. The corneal condition obscures view of the fundus.

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[1] Read before the American Ophthalmological Society, June 16, 1919.

Tension 35*mm* (Schiotz), vision, fingers at 1½ feet. Solution of pilocarpine nitrate 1% ordered to be instilled three times daily.

Jan. 10th.—Left eye painful and more congested. Pupil contracted and irregular. There appear to be some deposits on the posterior surface of cornea.

Jan. 11th.—Atropine sulphate 1% substituted for pilocarpine.

Jan. 13th.—Pupil dilated and irregular from posterior synechiæ.

Jan. 17th.—Tension lower. Pupil half dilated. Deposits on posterior surface of cornea persist.

Jan. 24th.—Less pain. Cornea still quite hazy.

Jan. 31st.—Some blebs on cornea as in bulbous keratitis. Tension only slightly elevated. Some pain at times.

Feb. 7th.—Very little pain. Cornea roughened and hazy. Moderate congestion.

Feb. 21st.—Tension normal.

Feb. 25th.—There are two spots in upper part of cornea that stain with fluorescine. Very little pain. Tension normal.

Feb. 28th.—Some superficial vascularization of cornea above. Pupil moderately dilated.

Mar. 21st.—Eye more congested. Cornea very hazy. Enucleation advised.

Mar. 22d.—Enucleation of left eye under local anæsthesia by Dr. Lancaster, eleven weeks after onset of keratitis.

PATHOLOGICAL EXAMINATION.

(3–2789.) Fixation in an aqueous solution containing formalin 10%, alcohol 54%.

Macroscopically.—The globe is normal in size and shape. The cornea is clouded by the method of fixation so that no details can be made out within it. Its surface is smooth and is covered with epithelium. There is a vascularized pannus all around, most marked above. The anterior chamber is slightly shallow, and contains a delicate serous coagulum. The lens is *in situ*. The filtration angle is everywhere free. The pupil is 3*mm* wide, and its margin is firmly adherent to the lens. The vitreous is normal. The retina and choroid are *in situ* and apparently normal. The disk is not swollen or noticeably cupped.

Histological Examination.—Fixation as noted above. Meridional vertical sections through most of the central portions of the cornea, and plane sections through the remaining central portion. Longitudinal sections through the

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ILLUSTRATING DR. VERHOEFF'S ARTICLE ON "A CASE OF KERATITIS PROFUNDA (OR DISCIFORMIS?) WITH MICROSCOPIC EXAMINATION."

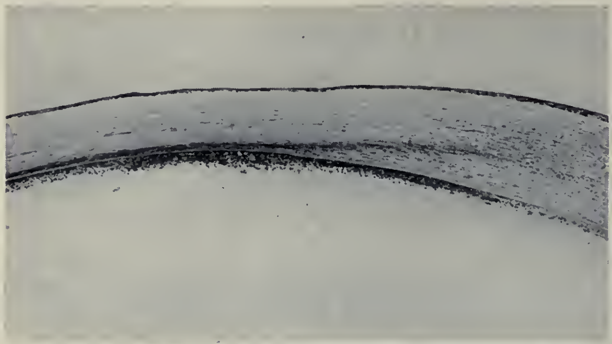

FIG. 1. Median vertical section of cornea showing half of affected area. (The other half presented a similar appearance.) The epithelium is intact but altered. The anterior layers of the central portion of the cornea are devoid of nuclei. In front of Descemet's membrane the corneal corpuscles have actively proliferated, forming a layer which rapidly widens out and disappears at the periphery. In the middle layers of the cornea some of the corpuscles show various stages of necrosis, others active proliferation. There is no infiltration with leucocytes. The endothelium is absent and the posterior surface of the cornea is coated with fibrin and leucocytes. Hæmatoxylin and eosin. Photo × 41.

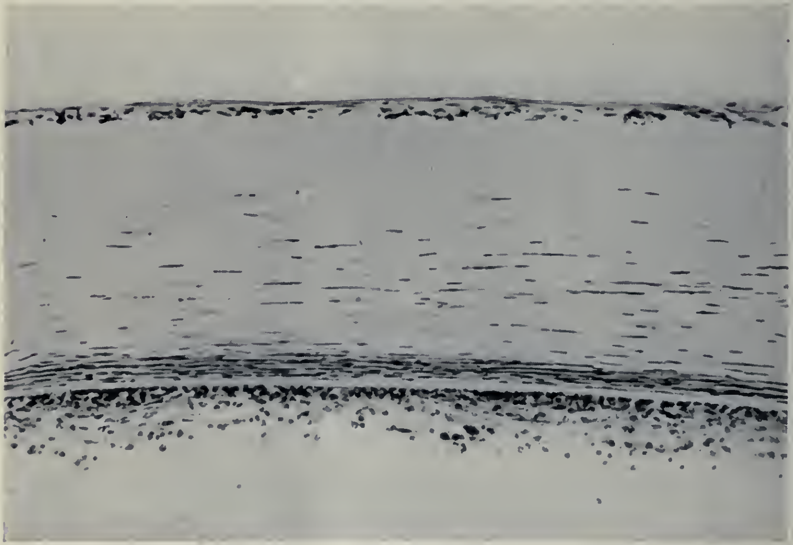

FIG. 2. Section of central portion of affected area of cornea under higher magnification. Hæmatoxylin and eosin. Photo × 150.

optic nerve nearly to the central vessels; serial cross-sections of the remainder of the nerve. Staining in hæmatoxylin and eosin and in a variety of other stains.

The most marked corneal changes involve a central area about 4.5*mm* in diameter (see Fig. 1). Here, in the anterior third of the corneal stroma, the lamellæ have become slightly hyaline in appearance and have lost their distinct outlines, while the corneal corpuscles have completely disappeared. In fact, no cells of any kind are present here (see Fig. 2). Posteriorly, the corpuscles become visible in small numbers, many of them, however, showing chromatolysis, pyknosis, or fragmentation of their nuclei, and others active proliferation. Just in front of Descemet's membrane, in a sharply defined layer about one seventh the thickness of the cornea, the corneal corpuscles are greatly increased in number, their nuclei are rich in chromatin, and many of them show various stages of amitosis or mitosis. At the periphery of the central area, this layer of proliferating corneal corpuscles extends away from Descemet's membrane and rapidly becomes broadened out and disappears. The corneal stroma shows no vascularization, and is almost free from leucocytic infiltration throughout, except near the limbus where there is slight infiltration with pus cells.

In this central portion, the cornea is reduced to about two thirds its normal thickness, probably owing to shrinkage and compression of the injured tissue resulting from the action of the fixing fluid employed. Bowman's membrane is everywhere intact. The epithelium is normal at the periphery of the cornea, but over the central portion, it is greatly altered. Here it is thinned, due to changes affecting the basal cells, the squamous surface layers being intact. The basal cells are shrunken and distorted, and their nuclei are often pyknotic. Many of the pyknotic nuclei are stretched out into irregular fantastic shapes. These changes are best seen in plane sections. In places there are small cystic spaces beneath the intact surface layers, containing discrete altered basal cells that have been cast off from Bowman's membrane.

Descemet's membrane is also everywhere intact. The endothelium is completely absent behind the central portion of the cornea, a stretch of 1*mm* of it remaining at the periphery below, and 4*mm* above. Behind the central area there is a layer of fibrin and leucocytes, about .04*mm* thick and 4.5*mm* in extent. Immediately in contact with Descemet's membrane the leucocytes consist almost exclusively of pus cells; the other cells enmeshed in the fibrin are chiefly endothelial cells, many of them containing pigment. Occasionally one of the endothelial cells is multinucleated. Many fibroblasts are also seen, indicating that organization has begun. Towards the periphery the layer of fibrin ends rather abruptly, but considerable numbers of pus cells and small and large lymphocytes are adherent to the cornea all the way to the filtration angle. About 5% of the polynuclear leucocytes are eosinophiles.

In addition to the large central corneal lesion just described, two smaller spots evidently of the same general nature are encountered. The spots are similar in character, but the sections pass through the center of only one of them. The latter is about .75*mm* in diameter. Within it the corneal corpuscles beneath Bowman's membrane for a depth of three or four lamellæ show marked pyknosis and fragmentation, while those still deeper are greatly increased in number and their nuclei show various stages of amitosis and budding. In this vicinity the stroma shows a slight infiltration with pus cells. Over the center of this spot the epithelium is markedly altered. The basal cells have disappeared as a definite layer, and the surface layers are lifted up, leaving a cystic space filled with discrete cells. The latter have only a small amount of cytoplasm, possess small nuclei of various sizes, and seem to have been derived from basal cells that have been cast off from Bowman's membrane. Intermingled with these cells there are also a few pus cells.

The tissue of the limbus is highly congested and greatly thickened by infiltration with chronic inflammatory cells, chiefly plasma cells. Extending between the epithelium and Bowman's membrane from above for 2.75*mm* there is a pannus somewhat similar in appearance to a pannus degenerativus. This is actively growing and is richly infiltrated with chronic inflammatory cells. A similar pannus is beginning below. A few vessels are just beginning to push their way from the sclera into the deeper layers of the cornea.

The filtration angle is nowhere blocked by the root of the iris. Below it is filled with leucocytes up to the level of the end of Descemet's membrane, and also contains a small amount of fibrin. Pus cells predominate here, but there are also many plasma cells, lymphocytes, and a few endothelial cells. The spaces of Fontana are filled with similar cells. A few new formed capillaries are making their way over the surface of the ligament, some of them beginning to extend over the posterior surface of Descemet's membrane. The serum filling the anterior chamber contains scattered leucocytes—about six to twelve to the high power field.

The iris is considerably infiltrated with chronic inflammatory cells, chiefly lymphocytes, but is not highly congested. The infiltration is greatest in the region of the sphincter where it tends to assume a nodular character. Along the anterior surface of the iris are numerous leucocytes, mostly lymphocytes, but almost no fibrin. There is annular posterior synechia 1*mm* wide. From the pupillary margin there extends a thin fibrous membrane over the surface of the lens, blocking the pupil. Over the central portion of this membrane there is a layer of fibrin in which a few leucocytes are enmeshed.

The ciliary body is almost normal, showing only a slight leucocytic infiltration. The retina and choroid are normal. The optic disk is possibly very slightly cupped. The central vessels, cut in serial cross-sections, are normal. The lens is practically normal, showing only slight cataractous changes at its periphery.

Bacteriological Examination.—Sections stained by the Gram method, the method for tubercle bacilli, and in carbolthionin, show no microörganisms in the cornea or elsewhere.

REMARKS.

This case was not seen by me clinically, and the clinical notes upon it were made by a house surgeon unfamiliar, naturally enough, with such rare conditions as keratitis disciformis and keratitis profunda. The clinical description, therefore, is not sufficiently detailed for a diagnosis to be made from it alone, but interpreted and amplified in the light of the microscopic findings it shows that clinically the cornea displayed a grayish circular opacity 4.5*mm* in diameter. Over this the epithelium was intact but presented a marked stippling of its surface, and on one occasion, vesicles. The margin of the opacity must not have been sharply defined, but was intensified by the zone of proliferating corneal corpuscles surrounding the main opacity. It is doubtful that this was sufficiently conspicuous clinically to form the intensified border described by Fuchs as characteristic of disciform keratitis. The thick layer of fibrin and leucocytes, however, on the posterior surface of the cornea had an extremely sharp peripheral outline, and may well have given a disciform appearance to the whole opacity as seen clinically. In addition to the central opacity there were two outlying superficial punctate spots, both of which were also seen microscopically. Both clinically and microscopically there was noted severe iritis with posterior synechia and deposits on Descemet's membrane.

From these facts it is obvious that this case was either one of keratitis profunda or of keratitis disciformis.

The opacity of the cornea was, no doubt, primarily due to alteration in the anterior layers of the cornea manifested microscopically by slight hyaline change of the lamellæ and destruction of the corneal corpuscles. Later it was greatly increased by the layer of proliferating corneal corpuscles in front of Descemet's membrane and by the thick layer of fibrin and leucocytes deposited on the back of the cornea. The changes in the epithelium in this case were most striking. Just how much importance to attach to them, it is difficult to determine, since the eye was removed under local anæsthesia and the cornea was exposed to drying and the action of cocaine for an unusual length of time. The distortion of the nuclei was almost certainly due chiefly to this cause. The other changes, however, were probably not artefact because they existed only over the affected portions of the stroma, namely over the central area and over the small punctate spots at the periphery. Moreover, I have never seen such changes in any other eye removed under local anæsthesia.

In the literature, no case diagnosed as keratitis profunda, and only two cases clinically diagnosed as disciform keratitis, have been examined microscopically, one reported by Hadano (1) the other by Meller (2). Hadano examined only a piece of tissue removed from the cornea by means of a sharp spoon, while Meller examined the entire eye. The findings in these two cases were so different that it is almost, if not quite impossible, to believe that the two cases represented similar conditions. Thus Hadano found that the small piece of tissue removed by him (he does not mention its exact size) consisted of a swollen mass of wavy interlacing bundles in which there was complete absence of inflammatory infiltration or tissue proliferation. Only a few nuclei were to be seen, and in the central area almost no nuclei were present. On the other hand, Meller found intense cellular infiltration with necrosis of the infiltrate and loss of corneal substance.

In my case, the microscopic findings were in accord with those of Hadano. The additional features found by me could not, of course, have been seen by Hadano, because he did not remove a sufficient thickness of corneal tissue to reveal them, while the appearance of wavy bundles described by him is no doubt explained by the traumatism to which the tissue was necessarily subjected during its removal.

The possibility may suggest itself that the changes present in the cornea in my case existed in Meller's case but were masked by a secondary infection. Careful examination, however, of sections from Meller's case, which were kindly sent to me by Professor Fuchs several years ago, excludes this possibility, for in these sections there is no trace of the hyaline condition of the corneal stroma nor of the layer of proliferating corneal corpuscles which in my case walled off the central area from behind and also formed a peripheral zone around it.

As pointed out, my case was certainly one of keratitis profunda or disciformis. Meller's case was just as certainly not one of keratitis profunda, for the great density of the corneal infiltration as well as the relatively extensive loss of corneal substance excludes this possibility. If, therefore, we assume that disciform keratitis is a distinct entity, and that Meller's case was a true case of this condition, we must conclude that my case and that of Hadano were cases of keratitis profunda. I am, however, not prepared to make either one of these assumptions.

As a matter of fact I am convinced that the cases of disciform keratitis described in the literature do not represent a single condition. Disciform opacity of the cornea may arise from a variety of causes. As is well known, it may occur in hereditary syphilis where it probably is due to a metastatic infection of the cornea with spirochætes, it may occur as a type of ulcus serpens, it may result from infection with vaccine virus, as pointed out by Schirmer (3), it may occur in non-gonorrheal ophthalmia neonatorum due to infection with the streptococcus mucosus as I have myself observed. Probably it may occur as a form of tuberculosis of the cornea as suggested by Weeks (4), and as a result of unknown infections. Finally, it may occur as a complication of herpes cornea or as a result of trauma, in which cases it is probably neuropathic in origin as maintained by Peters, although Fuchs's view that here also it is due to some unknown infection has not been excluded.

Possibly the cases of keratitis disciformis originally described by Fuchs did comprise an entity, but his clinical description is not sufficiently exact, and probably no description based upon clinical appearances could be sufficiently exact, to enable other observers to identify the condition with certainty. Moreover, such cases are seen by any one observer at such long intervals that it is unlikely that the clinical picture could often be carried in mind from one case to another. In the clinical description of his case, Meller states that after a time the infiltrate presented a sharply defined margin, but he does not mention here the intensified border described by Fuchs as characteristic of disciform keratitis. He does, however, attempt to reconstruct the clinical appearance from his microscopic findings, but in my opinion he fails to do so successfully. One of the sections of his case in my possession passes near the middle of the infiltrate, yet it fails to show anything which would give the appearance of an intensified border. His illustrations likewise fail to do so. In two other ways also his case did not conform to Fuchs's description, namely, in that the density of the infiltrate was unduly great for the small size of the latter and in that the loss of substance was relatively large. For, from measurements made from the section referred to, and from the illustrations of Meller's case, I find that the infiltrate was only *2mm* in diameter and the loss of substance involved half of this area. Owing to the necrosis of the infiltrate Meller was unable to determine the nature of the cells comprising it. It seems to me, however, that I can identify many of the cells as endothelial phagocytes and to determine definitely, at least, that the infiltrate does not consist chiefly of pus cells. This is substantiated by the fact that almost no pus cells are approaching it from the periphery. From the foregoing considerations I conclude that Meller's case, although not one of keratitis profunda, was not a typical case of disciform keratitis as described by Fuchs, and that it was not due to tuberculosis or to vaccine virus, but probably to infection of the cornea with some unidentified non-pyogenic microörganism.

The term keratitis profunda has been used in a general way for many years to describe various forms of deep-seated keratitis, including that of hereditary syphilis, but so far as I can ascertain Fuchs was the first to restrict its use to a distinct clinical entity. In his latest textbook (Duane's translation) he makes the following statement in regard to the differentiation of this condition from keratitis disciformis: "Keratitis disciformis has a certain resemblance to keratitis profunda, in which also a deep-seated gray, non-ulcerating cloudiness develops in the center of the cornea. But this is composed of gray striæ and specks and merges gradually into the transparent cornea. In keratitis disciformis, on the contrary, the opacity appears uniformly gray and only on strong magnification is resolved into very minute clear-cut, white, closely packed dots; moreover, it is very sharply demarcated from the healthy cornea by the gray circular line along its border."

Taken in connection with his detailed description of the two conditions, it seems to me that the points mentioned by Fuchs are not always sufficiently definite, and I therefore concur in the view of v. Hippel (5) that it is not always possible to differentiate the two conditions. In other words, I believe there are cases which present the essential clinical features of disciform keratitis but which are really of the same nature as keratitis profunda, and it is to this class of cases to which I believe my case and that of Hadano belong. This view harmonizes with the following statement made by me ten years ago:(6) "The facts that both keratitis profunda and keratitis disciformis occur most commonly after herpes zoster or trauma, that both may be associated with corneal hypesthesia and show outlying superficial punctate spots, impel me to believe that both conditions are essentially neuropathic, the minor differences between them being dependent on differences in the intensity of the nerve irritation."

The question now arises as to the indications the histological findings in the present case offer in regard to the cause of the condition, and as to whether or not these findings support the clinical evidence that keratitis profunda is neuropathic in origin. In the first place it is obvious that the central corneal lesion is due to some diffusible toxic substance arising in the anterior layers of the cornea. This is evident from the fact that the corneal corpuscles have been completely destroyed in the anterior third of the cornea and are progressively less injured from before backward, while next to the membrane of Descemet and at the periphery they have been stimulated by the weakened toxin into active proliferation. Likewise, the corneal lamellæ are most affected anteriorly. That this toxin was of infectious origin is highly improbable. For it seems impossible for organisms to have existed in the cornea for eleven weeks without causing leucocytic infiltration of any kind in the affected area. It is true that highly virulent organisms often produce toxins of such intensity that the latter prevent leucocytes from reaching the site of infection but in such instances the area is always surrounded by a zone of leucocytes and the infected tissue undergoes necrosis and breaks down. In the present case, the corneal corpuscles were destroyed in the affected area, but the stroma was only slightly injured, while the cellular infiltration even of the surrounding cornea was insignificant.

On the other hand, the histological findings in the present case are in perfect accord with the theory of neuropathic keratitis advanced by me in 1909, and again in 1911 (7). According to this theory, as a result of an irritative lesion in the gasserian, or possibly the ciliary ganglion, impulses are sent backward to the nerve terminals in the cornea where they produce electrolytic changes leading to the formation of toxic substances. The latter then give rise to corneal lesions, chiefly superficial, which vary in character according to the intensity and duration of the nerve lesion and the distribution in the cornea of the nerves corresponding to it. Thus a diffuse lesion in the ganglion involving the nerve supply of the central portion of the cornea would give rise to toxic substances at or near the surface of the cornea which in diffusing backwards would produce the changes described. The associated iritis could be explained either by the action of these toxins on the iris, or by a simultaneous involvement of the nerves of the iris. The deposit of fibrin and leucocytes on the posterior surface of the cornea is easily explained by the destruction of the endothelium by the toxins diffusing through the cornea, just as are explained the mural thrombi that are formed in veins when the endothelium is injured. Had it existed sufficiently long, no doubt it would have undergone complete organization.

The only previous case of neuropathic keratitis of any kind, uncomplicated by infection, in which the entire eye was examined microscopically, was the case of superficial punctate keratitis reported by me in 1911 (7). The punctate spots in this case were situated just beneath Bowman's membrane, and showed necrosis of the corneal corpuscles as in the lesions of the present case, but in addition were densely infiltrated with polynuclear leucocytes also in various stages of necrosis. The corneal lamellæ were only slightly injured and there was some proliferation of corneal corpuscles at the periphery of the spots. In both cases the epithelium over the lesions was altered but not destroyed. Aside from differences in size, therefore, the only important difference between the corneal lesions in these two cases consisted in the far greater leucocytic infiltration of the lesions in the earlier case. Three possible explanations for this difference suggest themselves: (*a*) That the leucocytes of the patient in the present case were less sensitive to the chemotactic influence of the toxic substances diffused from the cornea, although in both cases these toxic substances were the same in kind. (*b*) That in the first case the toxic substances were produced more rapidly and hence were more concentrated in their action. This is in accord with the fact that at the time of enucleation the duration of the lesions in the first case was about three weeks, in the present case, eleven weeks. (*c*) That early injury to the endothelium in the present case caused the diffusion of the toxins to take place chiefly into the anterior chamber. This is in accord with the fact that an abundance of polynuclear leucocytes were enmeshed in the fibrin on the posterior surface of the cornea.

Assuming that the present case was one of keratitis profunda it is obvious from the microscopic findings that this term is misleading. For, while the deeply seated changes in this form of keratitis are clinically the most conspicuous, it is obvious that the toxic substances which cause them arise at or near the surface of the cornea.

CONCLUSIONS.

Disciform keratitis may be produced by a variety of causes, and from an etiological standpoint is therefore not an entity.

Certain cases of disciform keratitis are of the same nature as keratitis profunda.

The corneal changes in keratitis profunda are due to the action of diffusible toxic substances arising near the anterior surface. The changes consist in alteration of the epithelium, destruction of the corneal corpuscles and injury to the stroma in the anterior layers of the cornea, and proliferation of the corneal corpuscles behind and around the injured area. In addition to this, there is injury to, or destruction of the endothelium, and in severe cases, deposition of fibrin and leucocytes on Descemet's membrane behind the affected area. Leucocytic infiltration of the corneal stroma is conspicuously absent.

The microscopic findings in the present case strongly indicate a neuropathic origin for keratitis profunda.

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JUDGMENT OF DISTANCE WITH SEMAPHORES AND A SCREEN AT 100 METERS.

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(With two figures in text and one figure on Text-Plate XIV.)

SINCE aviation became a science the term "judgment of distance" or, as some will call it, "stereoscopic vision" has come to have a new bearing. It takes such a slight error in judgment, especially in landing a plane, in order to produce disaster that the subject quite naturally has aroused serious attention. To learn to fly is like learning to walk. It is a new experience and it takes time to adapt oneself to new requirements. But unlike learning to walk, one fall may end it all. For this reason and others anything that may be done to choose properly those who can meet the requirements and to eliminate those who are physically unable to meet them is worth while. In other words, it must be regarded as a select game, not open to all. This is even more true when we are called upon to deal with flying from the military standpoint.

There has been a doubt in the minds of some, which has extended into cocksure opinions on the part of others that certain tests applied to applicants for flying service are unnecessary. From the outset then any attempt to exclude men from the opportunity of learning to fly is looked upon in some quarters as an "outrage."

Confidence in oneself is a good trait, but it may lead to an overestimation of one's ability. For instance, if a man has always been defective in certain ocular functions, he has not had the opportunity to develop that conscious understanding of what an individual with perfect ocular functions in comparison with himself can do. Therefore, he may be firmly convinced that he is "as good as the next man." It is a common experience to find an applicant trying to argue with and wheedle the examiner into "letting him by," when, *e. g.*, he cannot read $\frac{20}{20}$ or cannot show good stereopsis. For these reasons and others it is well for the examiner, first to be sure he is right, and then go ahead. He should have real convictions why certain men should be excluded from flying and he should have faith that the test he applies actually performs what it calls for.

If we as examiners are convinced that any test fails to measure up to the purpose for which it was intended, it behooves us to check it up with other tests or to discard it if something better is found.

The Problem.—In view of a somewhat widespread criticism of the hand stereoscope as a test for the judgment of distance, it was suggested that research be undertaken at the Medical Research Laboratory for the purpose of finding out, first, what the factors are that make men individually different in their ability to judge distance and, second, to devise an apparatus which would eliminate all irrelevant factors and test only the factor or factors which represent the individual.

In a previous report[1] it was shown that the representative personal factor which is important from the standpoint of aviation requirements is the binocular parallax. It was shown by the use of an apparatus which required tests to be made at six meters that it was possible to examine the binocular parallactic ability alone and to classify men according to their skill with this factor. In that paper it was stated what seemed to constitute normal findings. In order to supplement the experiments done with the six-meter apparatus, it was suggested that an outdoor test be devised for use at 100 meters or more. In order to make the outdoor test comparable to the conventional indoor test it had to meet the following requirements; avoid shadows, reflections, and linear perspective; also the test objects must maintain approximately the same visual angle irrespective of the difference in their distances from the observer. In this way the binocular parallax could be tested and the subjects thus examined be graded according to the resultant binocular parallactic angles.

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[1] "A Test for the Judgment of 'Distance,'" *Trans. American Ophthal. Society*, 1919.

Apparatus Employed.—The apparatus finally decided upon consisted of the following parts:

(1) A set of four circular disks or semaphores painted white and each attached to a wooden dowel of small diameter. The semaphores ranged from 12 to 13.3*cm* in width. In order to render the dowels invisible they were painted brown to match the color of an outdoor field.

(2) Tripods to hold in an upright position a piece of galvanized iron piping with a bore just large enough to receive a dowel.

(3) A board screen one meter high and two meters wide to be set upright a short distance in front of the semaphores in order to cut off all view of the tripods and avoid linear perspective.

The apparatus was set up using two semaphores at a time, the nearer one being exactly 100 meters from an observer and the other, which was a trifle larger in diameter, at a greater distance away. The lateral separation of the two semaphores was one meter, *i. e.*, the angle of separation from the position of the observer was one centrad. This was the same as the angle between the rods in the six-meter test. Figure 3 represents a set-up of the apparatus with the sunlight shining upon the semaphores in line with the intended observation.

The Test Applied.—One operator and one assistant were required to test each observer. The latter was required to stand at the 100-meter station with his back to the apparatus. The operator adjusted the semaphores and gave the signal "ready" to his assistant who was standing beside the observer. The latter upon receiving the message turned around, focused his eyes upon a spot near the bottom of the board screen, and then suddenly lifted his gaze to observe the rods. In this way he was able to secure a sudden impression which was found to be so important in the six-meter test. He was also urged to keep as still as possible while making an observation.

The observer was required to state which semaphore was nearer to him, the right or the left. His judgments were taken first at the six-meter depth difference station, then at the five-, four-, three-, two-and-one-half-, two-, one-and-one-half, and one-meter stations, or until it became apparent by the proportion of wrong judgments that he was merely guessing. With a few exceptions twenty judgments were taken at each station.

It was accepted that an observer's threshold had been passed when he failed at any station to make less than 75% of his judgments correct. Seven of the ten subjects had already been tried with the six-meter indoor apparatus so a comparison of the results of the two methods is possible.

Before proceeding with the discussion of the results obtained it may be well to consider the elements entering into the binocular parallax.

Principles Involved in the Binocular Parallax.—Figure 1 represents an observer viewing two objects, O and O′, at unequal distances from him. If O′ be brought into a line with O and one eye B as in Figure 2, the resultant diagram will give a more graphic idea of the angles and distances involved. In this figure let p = A B, the interpupillary distance; d = the distance B O to the near object, and D = the distance B O′ to the far object. Also let angle 1 = angle A O B, angle 2 = angle A O′ B, and angle 3 = angle O A O′.

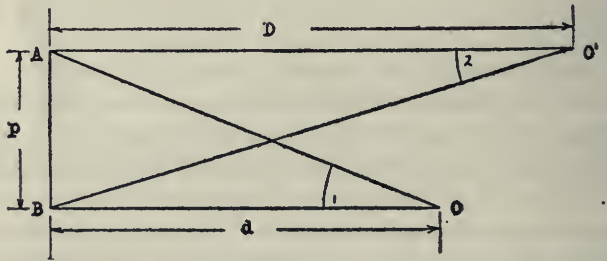

FIG. 1.—True representation of two objects O and O′ at unequal distances from the eyes A and B.
p = interpupillary distance AB.
d = distance to near object.
D = distance to far object.
D–d = difference in distance or the depth difference.
Angle 1–angle 2 = angle of the binocular parallax.

According to Figure 2, which furnishes a diagrammatic representation of the two distances D and d, the depth difference is D–d or △. Also angle 1 minus angle 2 equals angle 3, which is the binocular parallactic angle represented by the depth difference D–d.

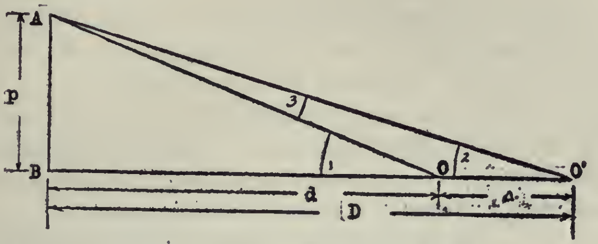

FIG. 2.—Diagrammatic representation of Fig. 1.
D–d = △ the depth difference.
Angle 1–angle 2 = angle 3, the binocular parallactic angle.

For small angles like angles 1, 2, and 3, the sine, the tangent, and the angle in radians may be considered equal with negligible error.

But the tan of angle 1 $= \frac{p}{d}$

and the tan of angle 2 $= \frac{p}{D}$

If we let r = angle 3 in radians,

then $r = \frac{p}{d} - \frac{p}{D} = p\frac{D-d}{Dd}$

Therefore, when p = 0.060 meters, d = 100 meters and D = 103 meters, by substitution

$r = .060\frac{3}{100 \times 103} = .00001747$ which represents the binocular parallactic angle in radians. In order to convert radians to degrees of arc we must multiply radians by $\frac{180}{\pi}$, and then this result by 3600 to reduce the result in degrees to seconds. Therefore, .00001747 radian = 3.60″, which happens to be the binocular parallactic angle of observer No. 2, as recorded in Table II.

On the basis of the above formula the binocular parallactic angles were computed for various interpupillary distances and for depth differences ranging from one to twelve meters. Table I, therefore, contains all the possible parallactic angles of the ten men of this series.

Method of Eliminating the Retinal Image as a Factor.—It is stated earlier in the paper that the test objects should maintain approximately the same visual angle irrespective of the difference in their distances from the observer. This was necessary in order to rule out the size of the retinal image as a possible factor in aiding judgment. I stated "approximately the same" because it is not required that they maintain exactly the same angle in order to appear the same size.

There were four semaphores available, two of which were used at a time. One was 12*cm*, one 12.3 *cm*, one 12.6*cm*, and the other 13.3*cm* in diameter. The 12*cm* semaphore was always set at the 100 meter distance from the observer. The other semaphores were used at the more remote stations, *i. e.*, 101, 102, 103 meters, etc. As a matter of fact another 12*cm* semaphore would have sufficed because if one of that size had been placed at the 105-meter station, for example, the difference in size of the visual angles at 100 and 105 meters respectively would have been less than the minimal visual angle that is perceptible. In this instance it would have been 11.8″ which is less than the minimal visual angle threshold I found in any of ten men, a record of whom has already been reported. Among these ten I found one whose least visual angle perceptible was 13.2″ while the average of the ten was over 15.5.″ However, in order to avoid any possible error I used the larger semaphores for the longer distances and therefore reduced the difference in visual angle to 4.6″ at the most.

In Table III has been recorded the size of the visual angle subtended by a 12*cm* semaphore when it ranges from 100 to 112 meters from an observer. At a distance of 100 meters the semaphore subtends an angle of 4.125′. Table IV is a computation showing the diameter of a semaphore required to maintain a visual angle of 4.125′ at distances also ranging from 100 to 112 meters.

Some Theoretical Considerations.—In a previous report mentioned elsewhere in this paper the results of experiments with an apparatus at six meters were recorded. While examining men for the purpose of finding and establishing a normal

ILLUSTRATING DR. HOWARD'S ARTICLE ON "JUDGMENT OF DISTANCE WITH SEMAPHORES AND A SCREEN AT 100 METERS."

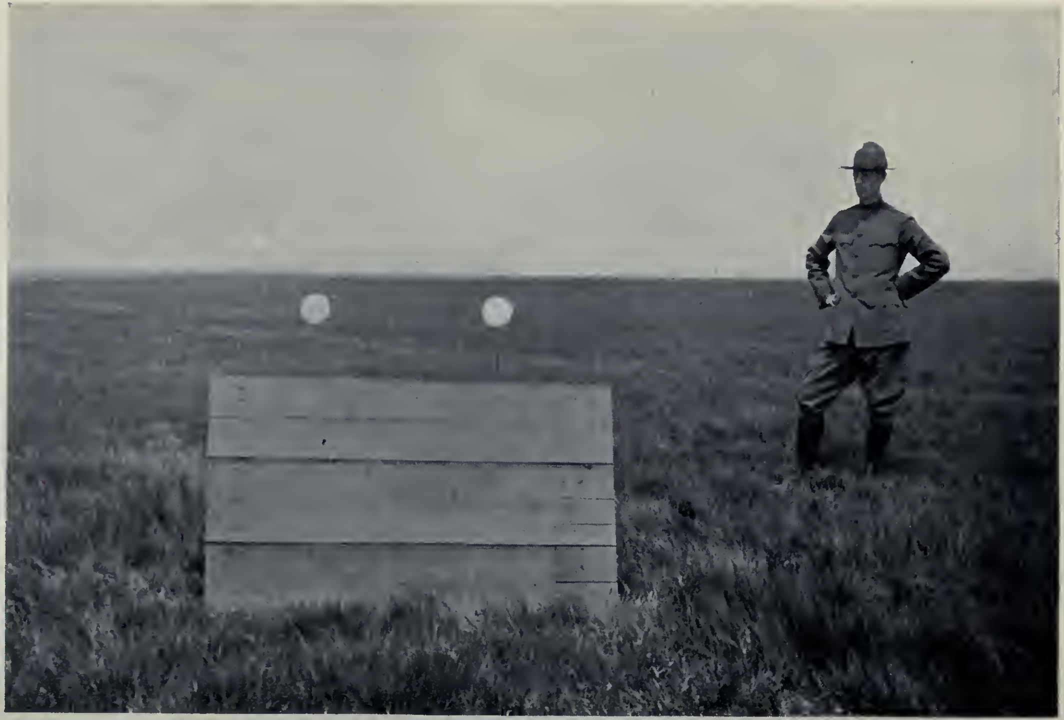

FIG. 3. A close-up view of the apparatus.

binocular parallactic angle, a number were found whose threshold angles were less than 2.0″. The smallest angle found was 1.80″, which represented an interpupillary distance of 63*mm* and a depth difference of 5*mm* when the nearer object was six meters away and the lateral separation of the two objects was one centrad.

Inasmuch as one writer, Eaton,[1] has made the statement that our "fusion sense," or the sense of depth or solidity afforded by binocular vision "cannot play any part at distances greater than 120 yards," it will be interesting to find out what the observer with a binocular parallactic angle of 1.8″ should theoretically be able to do at different distances. For instance, what would be the least depth difference perceptible when the near object is not six meters, but 100 meters away, and also one kilometer, two kilometers, etc., away.

If the parallactic angle remains constant while the distance increases, the depth difference varies approximately as the square of the distance to the first object. This, however, is true only when the depth difference is relatively small. For a distance to the first object of 100 meters there is an error of only 1*cm.* But for distances over 100 meters this approximate method of computation produces an error which increases greatly with the increase of distance. To be exact, the depth difference increases as the product of the two distances, *i. e.*, according to the formula already referred to

$r = p\,\frac{D-d}{Dd}$, where, if r and p are constant

$\frac{D-d}{Dd}$ must also be constant. Therefore, in the case of this observer

$\frac{D-d}{Dd} = \frac{0.005}{6.000 \times 6.005}$ (when the shorter distance is six meters).

Likewise, if the shorter distance d = 100 meters, we have

$$\frac{D-100}{100\,d} = \frac{0.005}{6.000 \times 6.005}$$

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[1] "Factors in Stereoscopic Vision and in the Visual Estimation of Distance," *Brit. Jour. of Ophth.*, vol. iii., No. 2, 1919, p 63.

But for the formula $r = p\frac{D-d}{Dd}$ previously employed, we can find the value of D (and therefore also of D − d) when the other factors are known, as they are in this case.

Then
$$\begin{aligned} r\,Dd &= pD - pd \text{ or} \\ D\,(p-rd) &= pd \quad \text{or} \\ D &= \frac{pd}{P-rd} \end{aligned}$$

Therefore, when D = 100 meters, p = 0.063 meters, and r = 0.00000874 radian (1.80″), by substitution

$$D = \frac{.063 \times 100}{.063 - (.00000874 \times 100)} = 101.4$$

Therefore,

$$D - d = 101.4 - 100 = 1.4 \text{ (meters)}$$

Similarly, results may be obtained when d = 1000, 2000 meters, etc., and the ability of the observer in question may be tabulated as follows:

Interpupillary Distance.	*Binocular Parallactic Angle.*	*Distance to First Object.*	*Depth Distance Required.*
.063 meters	1.80″	6 meters	0.005 meters
.063 "	1.80″	100 "	1.4 "
.063 "	1.80″	1000 "	161.6 "
.063 "	1.80″	2000 "	768.0 "
.063 "	1.80″	3000 "	2138.0 "
.063 "	1.80″	4000 "	4989.0 "
.063 "	1.80″	5000 "	11,321.0 "
.063 "	1.80″	6000 "	29,795.0 "
.063 "	1.80″	7000 "	235,308.0 "

Again for this same individual what must be the distance of the first object when the more remote is at infinite distance. It must be that distance at which his visual axes make an angle equal to his minimal binocular parallactic angle. Then angle 2 = 0 with its vertex at infinity. Therefore,

$$\text{angle } 1 = \text{angle } 3 = \frac{p}{d}\,\text{radian}$$

Likewise, the formula $r = p\dfrac{D-d}{Dd}$, which is the reduced form of $r = \dfrac{1}{d} - \dfrac{1}{D}$, becomes

$r = \dfrac{p}{d}$ when D equals infinity. Then by substitution

$$.00000874 = \frac{.063}{d} \text{ or}$$

$$d = \frac{.063}{.00000874} = 7208 \text{ (meters)}$$

In brief, the distance at which the nearer object must theoretically be, for this individual to perceive it as nearer than one at infinite distance, is 7208 meters, *i. e.*, his depth perception theoretically is limited to this distance. Beyond that, angle 1 itself is less than his minimal binocular parallactic angle of 1.80″.

For observer No. 1, in Table II, whose minimal binocular parallactic angle is 3.37″, the binocular parallax, as a positive factor, is limited to a much shorter distance. For him the equation would read thus:

$$d = \frac{.067}{.00001634} = 4100 \text{ (meters)}$$

Discussion of. Results.—Ten air service officers were examined by this outdoor apparatus. The examinations took considerable time and required great care to maintain always the operation of but the one factor, the binocular parallax. The assistant proved to be of great value in aiding the operator to secure a uniform height and illumination of the semaphores before the signal was given to the observer.

Photometric readings with a Macbeth apparatus were taken before and after several of the experiments. The average of three readings taken at the beginning of one test at 11 A.M. showed the illumination on a horizontal plane to be 5500 foot candles and on a vertical 4800. At 12 noon, when the experiment was finished, an average of three readings showed a horizontal illumination of 6300 foot candles and a vertical of 7300. At 2.30 P.M., that same day the horizontal readings showed 4200 foot candles and the vertical 9980. And at 3.30 P.M. the horizontal readings averaged 2030 and the vertical 6500 foot candles. The vertical readings were taken parallel to the line of sight when viewing the semaphores. The illumination during the other experiments compared very favorably with the two examples above, so the results of the tests are all comparable from the standpoint of good visibility.

By consulting Table II, it is noted that observer No. 1 had a depth difference threshold of 2.5 meters, which represents a binocular parallactic angle of 3.37″. His vision was $\frac{20}{10}$ — in each eye. He had perfect muscle balance and his interpupillary distance was 67*mm*, which was the widest of the ten men examined. The next two men, whose depth difference thresholds were 3 meters each, and whose binocular parallactic angles were 3.60″ and 3.73″ respectively, also had excellent visual acuity and perfect muscle balance. The other seven subjects, with one exception showed slight muscle imbalance, but very good visual acuity. Their thresholds varied from 4 to 6 meters and their minimal parallactic angles from 3.88″ to 7.53″. The average threshold for the ten was 4.15 meters and the average binocular parallactic angle was 5.19″.

Seven of the observers had previously been examined with the six-meter apparatus. A comparison of the results as recorded in Table II show a very consistent uniformity with the exception of the last case. The average minimal binocular parallactic angle obtained by the indoor test was 5.93″ as against the 5.19″ obtained by the outdoor method. Ten cases are admittedly too small a number from which to make very positive deductions or to try to establish the normal limit of the binocular parallax, but in view of the opportunity for comparison with the more convenient six-meter test, it seemed worth while to record the results, especially since they corroborated quite faithfully the findings of the other test and gave support to the principles upon which the latter test was based.

It should also be of interest to learn the results of an examination made with observer No. 8 the day following his first trial. On the second day there was low visibility on account of a moderately heavy fog and a cloudy sky. His depth-difference threshold the first day was five meters, while on the second day it was eleven meters. That is, his binocular parallactic angle was 12.67″, or more than twice that of the preceding day.

CONCLUSIONS.

1. The binocular parallax, even when acting alone, is capable of great depth perceiving power.

2. The binocular parallactic angle is computed from the depth differences of objects looked at, and from one's interpupillary distance. The minimal binocular parallactic angle varies greatly with individuals and seems to have a physical basis. From data collected it seems to be dependent upon visual acuity, visual symmetry, and muscle balance to a large extent.

3. Subjects examined with the 100-meter apparatus showed binocular parallactic angles ranging from 3.37″ to 7.53″, with an average of 5.19″.

4. The findings with the outdoor test coincide very closely with those of the six-meter indoor test, but do not warrant its substitution for the latter.

5. The size of the visual angle or the retinal image has nothing to do with the binocular parallactic angle. It is wrong, therefore, to associate the visual angle with binocular discrimination of distance. The visual angle threshold is often stated as being about one minute, whereas the binocular parallactic angle threshold has been found to be as small as 1.80″.

6. Our "fusion sense" or our binocular depth perceiving ability theoretically is of value up to a distance of several thousand meters. Practically it is less, because we are limited by our visual acuity.

TABLE I.—BINOCULAR PARALLAX IN SECONDS OF ARC.

Depth differences when the shorter distance is 100 meters; *e. g.*, one meter represents the second object at 101 meters.

Inter p. d. in mm.	1	1½	2	2½	3	4	5	6	11	12
59.	1.21″	1.80″	2.39″	2.97″	3.55″	4.68″	5.80″	6.89″	12.06″	13.04″
60.	1.23″	1.83″	2.43″	3.02″	3.61″	4.76″	5.90″	7.00″	12.27″	13.26″
62.	1.27″	1.89″	2.51″	3.12″	3.73″	4.92″	6.09″	7.24″	12.67″	13.70″
64.5	1.32″	1.97″	2.61″	3.25″	3.88″	5.12″	6.34″	7.53″	13.18″	14.26″
65.5	1.34″	2.00″	2.65″	3.30″	3.94″	5.20″	6.43″	7.64″	13.39″	14.48″
67.	1.37″	2.04″	2.71″	3.37″	4.26″	5.32″	6.58″	7.82″	13.70″	14.81″

TABLE II.—JUDGMENT OF DISTANCE IN TERMS OF THE BINOCULAR PARALLACTIC ANGLE.

(One semaphore at 100 meters with screen in front; the second semaphore at 101, 102 meters, etc.)

								Percentage of correct judgment at the following depth distances:								Comparison between results of:			
No.	Name.	Age.	Vision.	Muscle Balance.	N. P. Accom.	N. P. Conv.	Inter P. D.	1 m.	1½ m.	2 m.	2½ m.	3 m.	4 m.	5 m.	6 m.	100 Meters Depth-Difference Threshold	Test Binocular Parallactic Angle of	6 Meters Depth-Difference Threshold	Test Binocular Parallactic Angle of
1.	J. H.	30	R. 20/10 – L. 20/10 –	Orth.	130	80	67	48	—	60	76	80	75	100	—	2½ m.	3.37″	—	—
2.	H. T.	33	R. 20/15 L. 20/15	Orth.	150	90	60	—	—	40	60	80	80	100	100	3 m.	3.60″	10 mm.	3.44″
3.	H. L. L.	31	R. 20/10 – L. 20/10	Orth.	125	96	62	58	—	47	65	85	95	100	—	3 m.	2.73″	10 mm.	3.55″
4.	P. W. C.	46	R. 20/15 L. 20/15	Exo. ½ L. H. ½	325	100	64.5	40	60	70	—	90	80	90	100	3 m.	3.88″	10 mm.	3.69″
5.	P. D.	43	R. 20/10 L. 20/10	Exo. 2	185	55	65.5	50	55	45	—	70	90	90	100	4 m.	5.20″	—	—
6.	H. J. H.	39	R. 20/10 – L. 20/10 –	Exo. ½	145	70	59	50	60	58	—	60	64	80	100	5 m.	5.80″	15 mm.	5.06″
7.	N. B. L.	26	R. 20/15 L. 20/15	Exo. ½	130	88	62	50	—	60	50	40	65	80	100	5 m.	6.09″	20 mm.	7.08″
8.	C. R.	46	R. 20/15 L. 20/15 +	Orth.	275	55	62	60	80	40	—	60	70	90	100	5 m.	6.09″	—	—
9.	B. L. W.	56	R. 20/15 + L. 20/15 +	Eso. 4	310	75	67	50	—	70	56	25	65	90	100	5 m.	6.58″	20 mm.	7.65″
10.	F. W. H.	28	R. 20/15 L. 20/15	Exo. 1	135	67	64.5	—	—	60	—	35	55	70	95	6 m.	7.53″	30 mm.	11.03″
AVERAGE		37.8	O.U. 20/15 +	Orth.	191	77.6	63.4	50.7	63.7	55	61.4	62.5	74	89	99.4	4.15 m.	5.19″	16.4 mm.	5.93″

TABLE III.—VARIATIONS IN THE VISUAL ANGLE SUBTENDED BY A 12*cm*. SEMAPHORE AT DIFFERENT DISTANCES:

Distance in Meters.	*Angle in Meters.*
100	4.125
101	4.084
101.5	4.064
102	4.044
102.5	4.024
103	4.005
104	3.966
105	3.928
106	3.891
107	3.854
108	3.820
109	3.748
110	3.750
111	3.716
112	3.683

TABLE IV.—DIAMETER OF SEMAPHORE REQUIRED TO MAINTAIN A VISUAL ANGLE OF 4.125 MINUTES AT THE FOLLOWING DISTANCES:

Distance in Meters.	*Size of Semaphore in cm.*
100	12.00
101	12.12
101.5	12.18
102	12.24
102.5	12.30
103	12.36
104	12.48
105	12.60
106	12.72
107	12.84
108	12.96
109	13.08
110	13.20
111	13.32
112	13.44

COLOBOMA AND SO-CALLED CONGENITAL DISLOCATION OF THE LENS.[1]

By Dr. C. F. CLARK, Columbus, Ohio.

(*With one figure in the text.*)

IN 1894 I presented to this society the history of a case of binocular coloboma of the crystalline lens with accommodative power retained and a brief review of such cases as I could find in the literature available at that time in the library of the Surgeon General's office, and it has occurred to me that, as these cases are somewhat rare, it might be worth while to place on record the subsequent history of this patient's eyes with an interesting group of other cases which I have had opportunity to study during the past twenty-five years.

Coloboma and luxation of the lens of congenital origin, while perhaps generally regarded as clinical curiosities, have, in the group of cases I have had under observation, presented some features which have seemed to me worthy of careful study and, while the advanced students of embryology may have worked out some satisfactory theory which will account for the phenomena observed, certainly our textbooks and encyclopedias of ophthalmology, in their somewhat stereotyped presentation of the subject, have not offered an explanation which will entirely satisfy a critical observer.

It may be that some exhaustive and scientific laboratory work has been done which will supply a really satisfactory explanation of these anomalies but, if so, I have not had the good fortune to see the reports of the investigations on which such explanations are based and certainly such writers as have based their theories on the occasional instances of association of coloboma of the lens with coloboma of the iris and choroid and who speak with apparent confidence of the imperfect or delayed closure of the fœtal ocular cleft as the cause will have to revise their theories to account for the large number of cases which show no evidence whatever of coloboma of either the iris or choroid. The ingenious theories of some eminent writers of many years ago have been quoted in the textbooks from year to year as authoritative without being subjected to critical analysis, but I fail to see how some of the cases I have observed can be satisfactorily accounted for or made to fall in with these theories.

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[1] Read at meeting of American Ophthalmological Society, Atlantic City, June, 1919.

Many of us lack the deep and intimate knowledge of the embryology of the eye necessary to enable us to supply an adequate theory which will account for a coloboma occurring in the upper or lateral border of the lens, or for the existence of a pronounced coloboma of the lens with no defect in either the iris or choroid, but it does not require a deep knowledge of embryology to enable us to detect the inadequacy of the textbook theory which groups these cases together and is satisfied with a glib reference to the imperfect closure of the fœtal ocular cleft as an explanation of such phenomena.

It is not always agreeable for learned writers to acknowledge that they do not know but when one finds a manifestly inadequate theory quoted by one standard authority after another he is tempted to say that an explanation which does not explain is often worse than no explanation at all.

The case described by me in 1894 was very similar so far as the defect in the lens is concerned to one described by Cissel in 1890. My patient Edward S. of Marysville, Ohio, ten years of age, had marked asthenopic symptoms and a trembling iris with a marked coloboma at the lower border of each lens. I had his case under occasional observation from 1888 to the time of his death in 1912 and while there was some slight evidence of premature presbyopia at the time of his death at the age of thirty-four, his lenses had remained quite clear and his corrected vision had improved from $\frac{4}{18}$ to $\frac{5}{7.5}$—in each eye.

He attended school and reported to me from time to time on account of the occasional recurrence of asthenopic symptoms. These were relieved by a careful correction making allowance for the changes in his refraction which seemed to vary from year to year and to be due in the main to a gradual change in his lenticular astigmatism.[1]

In my report of this case of coloboma in Edward S. made in 1894, I made a rather full record of the refraction, both corneal and lenticular, and in my studies of the case after the lapse of many years it was interesting to note that while the myopia remained about the same, namely, R. −7.5 sph.; L. −5.5 sph.; the astigmatism increased from R. −1. cyl. axis 10°, L. −2.75 cyl. axis 170° in 1894 (at which date the corneal and total astigmatism were practically the same) to right, −3.50 cyl. axis 180° and left −5.5 cyl. axis 180° in 1912. An increase of the total astigmatism in the right of 2.5 D. and in the left of 2.75 D. is manifestly due to a change in the form of the lens. While in the case of congenital dislocation in Kenneth A. referred to above, there was, apparently owing to release from the pressure of the suspensory ligament, a considerable degree of myopia and a modification of the astigmatism apparently due to tilting of the lens.

Both of these cases were in boys who were under observation for many years, whose lenses remained clear and who had good vision when their varying refraction was properly corrected. In one there was a marked coloboma in the lower segment of the lens in each eye while in the other the lenses were dislocated upward and slightly outward. The changes actually observed in the refraction of these cases were apparently quite consistent with what we should naturally anticipate if we observe with care the phenomena of coloboma and congenital dislocation, and the point of great interest to me was that in spite of their deformities the lenses remained clear under the observation which was maintained for a series of years.

In the case of coloboma, the lens remained in the normal position but slowly changed its form, while in the case of dislocation it changed its position as well as its form, and in the latter case I would call attention to the fact that in congenital subluxation, so long as the anterior surface of the vitreous body maintains its normal curvature, the movement of the lens is apt to be such that its posterior surface slides on the wall of the lenticular fossa and the lens consequently tilts forward at such an angle as to produce a degree of regular astigmatism. While there are great variations in the size of the colobomata and the degree of dislocation in the cases I have had the opportunity to study the two cases referred to above may be taken as in a degree typical and I will only refer briefly to a few of the others which present some interesting points.

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[1] I wish to call special attention to this point as I have observed it in a number of the cases of coloboma which I shall report and to contrast it with astigmatism occurring in a case of congenital dislocation in Kenneth A. in which latter case it seemed to be due, at least in part, to the inclination or tilting of the lens which, released from the pressure of the suspensory ligament, also caused a marked degree of myopia remaining about the same for many years.

Out of a total of eleven cases of this class occurring in my practice during a period of thirty-five years, eight had coloboma and four had congenital dislocation, in one case both coloboma and dislocation were found in the same patient, and, while the textbooks and encyclopedias almost invariably speak of coloboma of the lens as associated with and dependent upon the same causes as coloboma of the iris and choroid, in *not one of my eleven cases*, and a considerable number of instances in which coloboma of the iris and choroid were observed, could I find the two conditions associated. I am again calling attention to this point as I wish to emphasize the fact that an ingenious theory concerning a somewhat obscure histological subject, if proclaimed by some high authority, will go unchallenged for years though a careful analysis of the facts may afford no warrant for its acceptance.

Of the eleven cases referred to above, it is interesting to note that seven occurred in the descendants, in two generations, of one man and that there is room for a strong suspicion that both he and his father had similar trouble. The record of this interesting family will be found on the accompanying chart in which an effort has been made to present the relationship of the various members of the group in as condensed a form as possible.

A number of these patients have been under observation for periods varying from six to twenty years and, as in most instances the lenses have remained clear and in other respects the eyes have been normal, they have afforded an opportunity to study the variations in the refraction of an eye which may be supposed to accompany certain changes in the shape of the lens, apparently resulting from, first, the absence or relaxation of a sector of the suspensory ligament as in coloboma; second (in luxation), the increased rotundity of the lens increasing its refractive power, and, third, the astigmatism resulting from the inclination of the axis of the lens as, in its luxation, it follows the curve of the lenticular fossa.

To follow and accurately account for all of the optical phenomena resulting from slight changes in the lens or its position in the lenticular fossa would demand a degree of skill to which I lay no claim, but a simple record of some of these cases will, I think, be of interest.

Even in the cases of small colobomata or slight subluxation asthenopic symptoms were not uncommon and a revision of the refraction from time to time gave marked relief. The degree of accommodative power retained in spite of a large coloboma and marked trembling of the iris was quite remarkable but when the refraction was accurately corrected, it was still more remarkable to see how much comfort the patient would obtain and one would be surprised to see *how slowly* variations in the refraction of the lens took place. The best demonstration of these changes in coloboma of the lens was found in the case of Edward S. mentioned above, which case was first reported to this society in 1894.

In the H. family illustrated in the chart, whose members demonstrate so fully the various possibilities of coloboma and dislocation, there are shown among the younger generation two cases: Miss Jewell H. (5 A) and Miss Bertha A. (8 A), who, in spite of their well-marked colobomata have good accommodative power, astigmatism which has remained practically the same since they have been under observation, and, when corrected, practically normal vision. Miss Jewell H. (5 A) has been under observation for six years and her cousin, Miss Bertha A. (8 A) for seven years. A third member of this group, Miss Millie H. (5 B) has been under observation for some sixteen years, but as she was very young when first seen the refraction was not accurately worked out at that time, and there seemed to be a degree of amblyopia, the vision with a correcting lens being only $\frac{6}{15}$ right and $\frac{6}{20}$ left but, after wearing an approximate correction for fourteen years, she was able in 1917 to obtain almost normal vision in each eye:

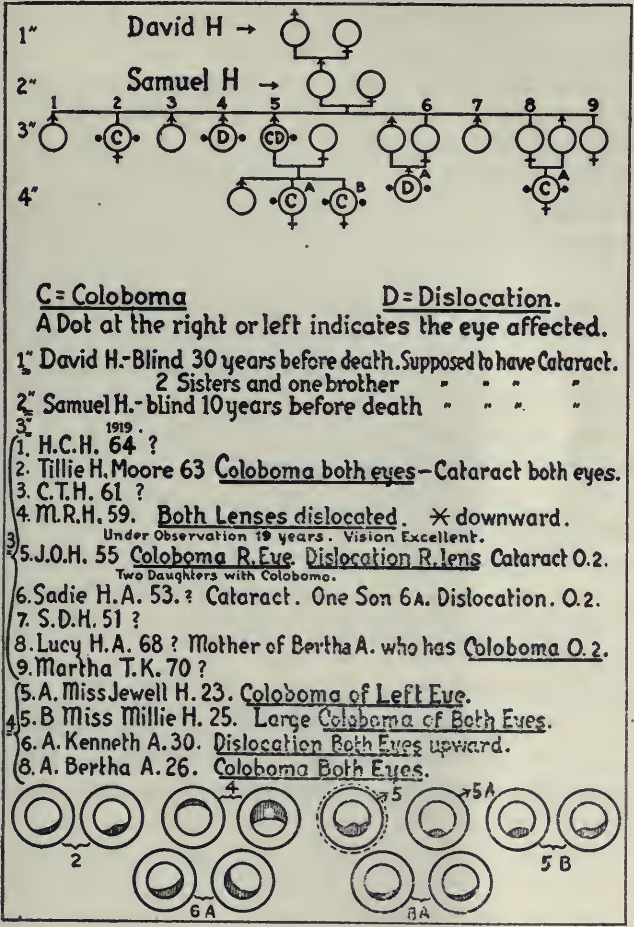
R. − 2. sph. ⊃ − 2. cyl. axis 180° = $\frac{5}{4}$ −
L. − 2.25 sph. ⊃ − 3.5 cyl. axis 165° = $\frac{5}{6}$ −

and this remained practically the same when she was last seen in March, 1919. These three are still young people and, if I may judge by my experience with other cases, I would be inclined to look forward to somewhat marked changes in the astigmatism of their lenses when they are a little older.

In a few instances, generally rather late in life, opacity has developed in the colobomatous lens, but in most of my cases, the truncated border of the lens has been apparently clear and free from evidence of any disease or disarrangement of the lens cells resulting in opacity. While in congenital dislocation of the lens it is not uncommon, as in the case of Kenneth A. (6 A in the chart) to find on the lens border the remains of the stretched or ruptured fibers of the suspensory ligament, I can now recall no case of coloboma in which such evidences of a suspensory ligament were to be found and in the larger colobomata the truncated border while rounded and thick was smooth and clear. I fail to understand how, if our commonly accepted theories of the mechanism of accommodation are correct, we can have the suspensory ligament absent over as much as one third of the periphery of the lens and still have only a moderate degree of astigmatism and good accommodative power. This would seem to cast some doubt upon the theory of so-called dynamic astigmatism due to a contraction of a sector of the ciliary muscle.

In only two of my cases (Tillie M. (2) and Millie H. (5 B) in the chart) were the colobomata large, and in Tillie M., forty-seven years of age, cataract was so far advanced when she was first seen that a study of her accommodative power was of course out of the question.

It is not difficult to understand how the normal tension on the suspensory ligament can maintain the flattening of the elastic lens of a young person and allow of a fair degree of accommodation in the relaxation accompanying contraction of the ciliary muscle even in the presence of a small coloboma, but it would give me great pleasure to hear from some of the members of this Society who have given attention to the problems involved in the physiology of refraction and accommodation as to how, when one third of the lens periphery is no longer connected with the ciliary muscle, we can still have good accommodative power.



C = Coloboma D = Dislocation.
A Dot at the right or left indicates the eye affected.
1" David H.-Blind 30 years before death. Supposed to have Cataract.
2 Sisters and one brother " " " "
2" Samuel H.-blind 10 years before death " " " "
3" 1919.
1. H.C.H. 64 ?
2. Tillie H. Moore 63 Coloboma both eyes—Cataract both eyes.
3. C.T.H. 61 ?
4. M.R.H. 59. Both Lenses dislocated. ✱ downward.
Under Observation 19 years. Vision Excellent.
5. J.O.H. 55 Coloboma R. Eye. Dislocation R. lens Cataract O.2.
Two Daughters with Coloboma.
6. Sadie H.A. 53. ? Cataract. One Son 6A. Dislocation. O.2.
7. S.D.H. 51 ?
8. Lucy H.A. 68 ? Mother of Bertha A. who has Coloboma O.2.
9. Martha T.K. 70 ?
4"
5. A. Miss Jewell H. 23. Coloboma of Left Eye.
5. B Miss Millie H. 25. Large Coloboma of Both Eyes.
6. A. Kenneth A. 30. Dislocation Both Eyes upward.
8. A. Bertha A. 26. Coloboma Both Eyes.

In one case in this family, J. O. H., a man of 55 (No. 5 in the chart) we have a small semicircular coloboma of the lower border of the lens associated with dislocation upward and somewhat advanced cataract. This man is the father of two of the girls mentioned above, Miss Jewell H. and Miss Millie H.

The surprising conditions that may develop in the life history of a case of congenital dislocation of the lens are well illustrated in Mr. M. R. H. (No. 4 on the chart) whose case was described in a paper on "Dislocation of the Lens" read before the Section of Ophthalmology of the Ohio State Medical Association. As he is a member of this family group and his case is a very unusual one, I will briefly present some of the points of interest which bear on the subject under discussion.

On consulting me in July, 1899, this man had partial dislocation of both lenses downward and, while he stated that he had always been "nearsighted" he gave an account of a sudden and very marked impairment of vision following violent exertion. This sudden impairment had occurred in the right eye some four years, and in the left some twenty-four hours, before he consulted me. In the right eye the stretched superior portion of the suspensory ligament could be plainly seen.

Taking into consideration the family history, the account he gave me of the accidents, and the appearance of the eyes, I was of the opinion that I was dealing with a man who, like his nephew, Kenneth A. (6 A in the chart), whom I saw two years later, had a congenital dislocation, probably upward, which, in his case by a sudden jar had been converted into a dislocation downward.

The glasses he had been wearing, R. + 2.25 sph.; L. + 2. sph. ⊂⊃ − 8. cyl. axis 180° were evidently given to correct vision through that portion of the lens which remained in the pupillary area, but much better vision was obtained through the aphakic portion of the pupil. This, however, required the use of a strong lens, + 15. sph. right and + 16. sph. left in addition to the correction of his corneal astigmatism, showing that the eyes prior to the dislocation of the lenses were normally hyperopic, but a portion of this hyperopia was neutralized by the increased refraction of the more rotund lens released by the luxation from the restraint of the suspensory ligament. It is also probable that the high degree of lenticular astigmatism was at least in part due to the tilting of the lens.

The recently luxated left lens in this patient was still movable and by placing him alternately on his back or having him lean forward with his face down, I could obtain varying states of refraction as the lens was nearer to or farther from the retina, and again on carefully placing his head in the vertical position he could, with proper correction, see well through the crystalline lens but, on shaking his head, the lens would fall low enough to enable him to obtain excellent vision over its upper edge.

Both lenses finally settled to a point 1 or 2*mm* below the horizontal meridian and have remained in that position for many years apparently causing no symptoms of irritation and allowing the patient with proper lenses, R. + 18.5 sph. and the left + 18. sph. ⊃+ l. cyl. axis 15° to obtain almost normal vision in each eye. This was in 1903: R. $\frac{5}{6}$ – and L. $\frac{5}{5}$ – and in 1919 it was, with the same lenses, R. $\frac{5}{9}$ – and L. $\frac{5}{7.5}$ –

There is some prominence and slight fading of the iris in the inferior quadrant at the point where the lens presses it forward and the pupils are only about 2*mm* in diameter in ordinary light and reduced to 1½*mm* in strong light and almost straight on their lower borders. A remarkable feature of this case is that with the strong lenses which he has worn constantly for sixteen years he has had practically normal vision for distance with either eye or both eyes in combination, and at the same time reads fine print with ease.

Whether this "accommodation" is obtained by virtue of the stenopæic pupil alone, or by this in combination with the inclination of the strong correcting lens (as suggested by Dr. Risley), I leave for your decision but, on the occasion of his last visit on April 24, 1919, he had with the right + 20. $A = \frac{.18 - .51}{.75} = .33$ and with the left + 20. sph. ⊃ + l. cyl. axis 15°, $A = \frac{.21 - .50}{75} = .29$

The literature of ophthalmology contains many various and curious instances of coloboma and congenital dislocation of the lens, but the phase of the subject which has interested me most deeply is the side light which some of these cases throw on the study of refraction and accommodation. What is spoken of by some writers as dynamic, lenticular astigmatism, the form of astigmatism which changes with the act of accommodation, might naturally be supposed to be modified by a condition of the eye in which a relatively large sector of the lens periphery is left entirely without connection with the ciliary muscle, but we are surprised to find that in some of the younger cases, not only is there very little lenticular astigmatism but that, with the refraction corrected, both vision and accommodation are practically normal.

The successful study of this subject requires that we should have our cases under observation from time to time for a series of years, preferably from childhood to forty or fifty years of age. Only a few of my cases approximate these conditions but I hope that some one may be able to follow the future history of certain of these eyes and we may thus learn from actual observation rather than by theorizing what the ultimate effect is when, without other complication, a clear lens goes through its life with a considerable portion of its periphery unattached to the ciliary muscle.

I venture the opinion, subject to correction and revision, that a careful study of the cases of Edward S. (whose record is continued in the early part of this paper from the account given in my first report in the transactions for 1894), and those cases of coloboma in the fourth generation of the H. family as shown on the accompanying chart will warrant the following conclusion: In youth the elasticity of the lens is such that, in spite of the absence of the zonular fibers over a relatively large sector of the lens, accommodation for that portion of the lens opposite the normal pupil may be satisfactorily accomplished without a marked degree of lenticular astigmatism being apparent, but as the lens gradually becomes rigid with age (and this age is a relative term) an increasing degree of astigmatism of the lens is developed.

A CASE OF BILATERAL GLIOMA OF THE RETINA APPARENTLY ARRESTED IN THE NON-ENUCLEATED EYE BY RADIUM TREATMENT.[1]

By MARK J. SCHOENBERG, M.D., New York.

AXENFELD reported in the *Klinische Monatsblaetter f. Augenheilkunde* of 1914 (vol. lii.) and of 1915 (vol. liv.) on the case of an eight months' old baby with glioma of the retina of both eyes. The right eye was enucleated, and the left eye, containing several foci, was treated with mesotorium and X-rays. The results obtained by Axenfeld were so encouraging that I applied the same treatment in my patient herewith reported.

Alice W., 5 years of age, came under my observation on March 15, 1916, when two years old, with the following history: Mother had noticed that when the child was only one month old, "the shine of the pupil of the left eye was different than it ought to be." No attention was paid to this condition until a few days before calling on me. Examination revealed a typical clinical appearance of a glioma of the retina of the left eye. The other eye also showed a mass adjoining the optic nerve and extending from it downwards and nasally. Personal and family history negative. No history of infection or trauma in child or mother during pregnancy or after birth.

On March 17, 1916, the left eye was enucleated and while under the influence of the anæsthetic the right eye was carefully looked into. It was then found a sharply circumscribed, grayish white tumor, limited above and below by branches of the retinal artery, occupying an area a little larger than a quadrant of the eyeground, extending from the margin of the disk nasally and below, towards the periphery, but not reaching the latter. This area was surrounded on all sides by patches of choroidal atrophy with pigmented borders. In its central portion were two small spots of gliomatous degeneration. Above, way over to the periphery, was another small grayish mass occupying an area of about 4–6 disk diameters.

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[1] Case presented before Section on Ophthalmology, New York Academy of Medicine, May, 1919.

Prof. J. Ewing (Dept. of Pathology, Cornell University Medical College) had the kindness to examine the enucleated eye and reported as follows: "Typical glioma of the retina. The tumor is composed of very small cells, consisting chiefly of nuclei, sometimes arranged in small rosettes and quite characteristic of glioma retinæ." A few days after the enucleation the child was referred to the General Memorial Hospital of New York where it received a course of radium and Roentgen rays treatments under the able direction of Dr. H. H. Janeway. On April 10, 1916, first radium treatment: radium emanation 36 millicuries with lead filter, applied to the right temple for four hours. On Sept. 22, 1916, second treatment: 58 millicuries, filtered through a 4 sq. *cm* lead plaque, held over the eye at a distance of 1*cm* for eight hours. On June 7, 1918, a third radium treatment was given: 209 millicuries over the right side of the orbit, kept for fourteen and one half hours, filtered through plaques of lead 2*mm* and silver ½*mm* thick.

Repeated fundus examinations were made during the past three years not only by the writer but also by late Dr. O. Schirmer, Drs. C. W. Cutler, A. Knapp, and J. Weeks.

On March, 1917, the condition was found as follows: Optic disk distinctly visible, sharply outlined; temporal half somewhat pale. Vessels normal; nasal and lower branches appear slightly enlarged. There is a large area, whitish of color, occupying the nasal lower quadrant, reaching with one angle nearly up to the margin of the optic disk and stretching towards the periphery at a distance of about 20 disk diameters. The color of this area is slightly yellowish gray. There is a number of sharply outlined, lighter yellow spots present, especially in the lower nasal angle. The whole mass is distinctly prominent but not very considerable. The outlines are not sharp, rather cloudy. The whole mass is surrounded nearly entirely by old choroiditic spots, consisting of white, sharply outlined patches, surrounded by pigment or containing pigment. When the child looks straight upwards one sees rather near the periphery another large yellowish gray spot of about 10 D. D. The vessels going to the spot are considerably dilated and tortuous. The appearance of the spot in color and outline is the same as in the upper mass and are still more marked, sharper outlined, and larger. No choroiditic changes around this mass. The age of the patient, the color of the tumors, and the glistening spots of their surface speak for glioma.

May 22, 1918. Patient feels and looks well. Names small pictures at a distance of 6–8 feet. The growth is about 6 D. high. It shows three glistening whitish spots of retinal degeneration and a portion of an arterial branch running horizontally across it for a distance of about 3–4 D. D. The mass gradually slopes down towards the area where the choroidal patches are. The upper growth shows no choroidal changes surrounding it.

Sept. 30, 1918. Patient weighs forty pounds, feels and looks well. Upper growth possibly a little larger. Posterior portion of lens, very near the pole, shows a pellicle like opacification, surrounded by dust-like fine opacities, scattered in the posterior cortical layers.

Nov. 11, 1918. Gaining weight (47 pounds) V. $\frac{20}{100}$ plus. The lower growth seems lobulated, white, smaller in extent but apparently elevated, it partly seems to cover the lower and inner ⅓ of the disk. The mass looks now more like an exudate, whitish, silvery prominent, woolly. Tension normal.

Dec. 5, 1918. A circumscribed circular opacity at posterior pole of the lens surrounded by dusty opacities. Vitreous clear. An organized vitreous opacity covering over the retinal mass. The latter consists of an irregular, lobulated area, apparently very slightly raised, of extreme white color, over which blood-vessels run. Some of these white masses have glistening white areas of degenerated portions of retina. The mass is surrounded by patches of choroidal atrophy. At the extreme upper and nasal periphery there is a similar process, very much smaller in size.

At the last examination of the patient, made in June, 1919, the condition was the same. The child looks and feels well. The opacities in the lens appear slightly more dense. The fundus appearance did not change. The impression is gained, that all that was left of the glioma is a degenerated necrosed mass. As to the upper focus, the appearance is about the same, but being situated at the extreme periphery, it cannot be examined any length of time (the child does not keep quiet long enough).

So far, there are two other cases of glioma of the retina reported in literature, which have been treated successfully by X-ray and radium. One is Hilgartner's case (after Pusey and Caldwell, *Therapeutics of Roentgen Rays*, p. 609), a child

3½ years old with a glioma, filling up the right eyeball and a small growth in the left eye. After eighty-four exposures to X-rays the right eye shrunk to ⅔ of its size and the growth in the left eye resorbed. There is no microscopic examination of the growth and, of course, this weakens the evidence as to the accuracy of the diagnosis.

The Axenfeld case concerns a baby, eight months old, which came under his observation in 1914. One eye was filled by a gliomatous mass; in the other eye there was one small tumor above at the beginning, but later on two more small foci appeared. The eye with the large tumor was enucleated and the microscopic examination revealed the presence of a typical glioma. A course of mesotorium and X-ray applications was given to the other eye over a period of one year and the report at the end of the course is most encouraging. "The optic disk is normal. The tumor below the macula has almost completely disappeared. All that can be seen is a small spot corresponding to the central portion of the area where the tumor was situated. The smallest tumor shows two lobes connected by a narrow bridge. Its appearance has changed considerably. Its periphery shows grayish green almost flat patches. The entire tumor is very much less prominent. No pigment spots to be seen anywhere near this tumor."

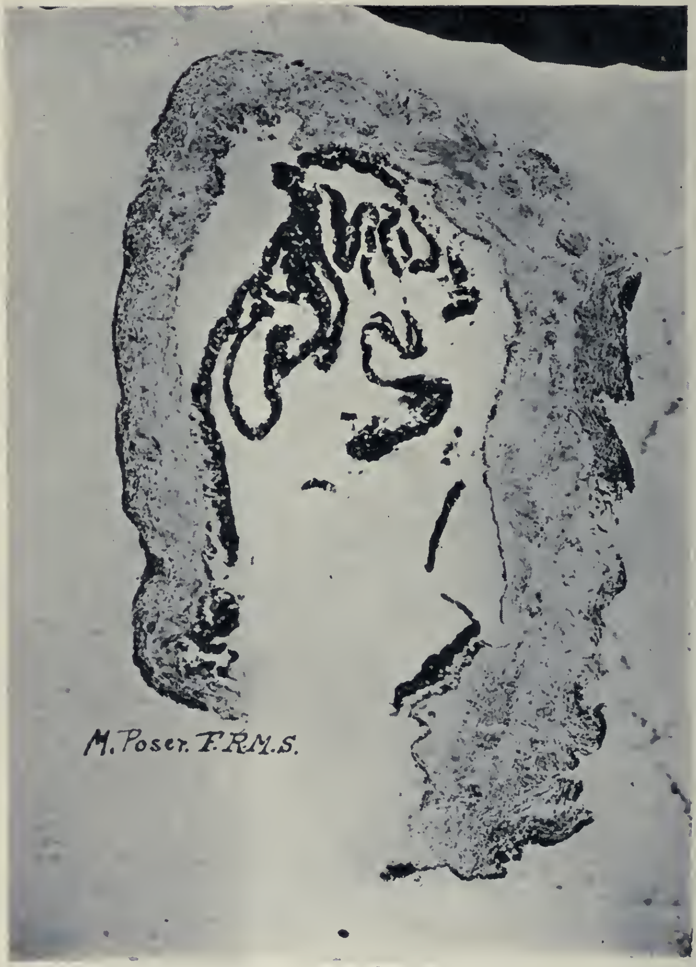
Axenfeld thinks that the X-ray and mesotorium have had an elective action upon the new growth cells but that future experience will show whether the brain tissue is at the same time influenced in any way by these rays. He advises to watch the mentality of the patients. The lens remained clear.

My patient presents a number of features worth pointing out: (1) The length of time under observation (over three years). (2) The microscopic evidence as to the correctness of diagnosis. (3) The chorioretinal patches surrounding the growth. (4) The lenticular changes during the treatment. (5) The good vision, and general condition and the absence of increase of tension three years after the glioma had been discovered and treated. (6) The apparent arrest, recession, and degeneration of the gliomatous masses.

The report on the final outcome of this case will be made in due time.

488'

Illustrating Dr. Lloyd's Article on "Phantom Intraocular Tumor. Multilocular Cyst of Iris and Ciliary Body."



PHANTOM INTRAOCULAR TUMOR. MULTILOCULAR CYST OF IRIS AND CILIARY BODY.

By RALPH I. LLOYD, M.D., F. A. C. S., Brooklyn, N. Y.

(*With one illustration on Text-Plate XV.*)

M. F., came to the clinic of the late Dr. A. B. Norton, complaining of poor vision in the left eye. He was a tailor, aged 51 years, and says the failure of vision dates back only three months. The vision of the right is $\frac{20}{30}$ without correction but he can only count fingers at two feet with the left eye.

Correcting glasses were tried without benefit to the poorer eye. Examination of this eye revealed a cortical cataract located near to the posterior pole and not large but dense. There was very little general lenticular haze surrounding the opacity and no spicules running in from the periphery.

The interior of the eye could be thoroughly examined with the pupil dilated and there were a few pigment flecks visible on the anterior surface of the lens. The nasal portion of the iris was pushed forward and by looking down and in through the pupil, one could see a light colored mass located between the iris and the lens and a narrow band leading backward to a dark colored mass which was posterior to the lens and evidently on the inner surface of the ciliary body. When the pupil was dilated, the mass was more easily seen and it then appeared as if made of several smaller masses. Transillumination was perfect and we were unable to find any interference with light transmission. To the fingers, tension seemed normal or less and the readings taken with the Schiotz instrument were 10–12*mm* for the right and 12–13 *mm* for the left. The McLean instrument gave us 18–19*mm* for the right and 25*mm* for the left. The pupil was dilated and the tension taken with the Schiotz instrument and we find the tension under mydriasis to be 16*mm* as compared with 12–13*mm* without. The Wassermann test was reported negative.

> Because of excellent light transmission, lobulated appearance, unchanged tension and color, suggested a cystic tumor of the iris or the ciliary body because the mass might easily project from the ciliary body and reach a place between iris and lens and give the impression that it originated in the iris.
>
> The pigment flecks on the anterior lens surface with a cataract of a type which suggested a cause within the eye itself, made us think of uveal disease but there were no floating opacities present. Literature contains ample precedent for removal of the eye in suspicious cases but it seemed best to make an iridectomy and carefully examine the section removed. Dr. Norton approved of this plan and the iridectomy was done without incident other than profuse hemorrhage which was anticipated. The iris repositor was used without being able to see whether the iris was returned to proper position or not. The blood clotted at once, quite a little escaped from the incision, but there was nothing further except a puckering of the lens capsule, half-way between center of lens and inner border, where the blood clot organized in a small mass.
>
> After the chamber cleared, nothing of the former mass was to be seen nor did the section removed from the iris appear abnormal. Also, the band spoken of and the dark colored mass behind it in the vitreous chamber have both disappeared. On the lens surface, close to the inner margin is a light colored smear.

For this state of affairs, we were prepared because of an article by Dr. A. Knapp, page 609, vol. xl., ARCHIVES OF OPHTHALMOLOGY. Here is described a very similar condition but the mass was dark in color. The patient's eye was also pushed far forward by what was later found to be an aneurysm of the ophthalmic artery. The section of iris was sent to Dr. DeNyse of the Carson C. Peck Hospital Laboratory who says "the epithelial layer of the iris posterior surface is detached and this may or may not be pathological. The layer is very much reduplicated, contains pockets, and is in excess of the amount necessary to properly cover the surface allotted. Without doubt, this layer has been ballooned by fluid." A microphotograph of the section is offered. The angulation of the section is due to the folding of the iris in the grasp of the iris forceps.

The sections are cut at right angles to the radius of the iris, crossing the mass of the tumor and the pupillary margin does not appear. No effort was made to get every bit of the tumor because a small iridectomy was preferred, if the mass was innocent, while the eye would have been removed at once had the microscopist reported malignancy present. The case seems a rather rare one, but the usefulness of careful reports in making diagnosis in doubtful cases or assisting in shaping the course of treatment is prominent because I very much doubt whether we would have done as we did had not the case report in the ARCHIVES been in our mind.

A CONTRIBUTION TO THE STUDY OF DARK-ADAPTATION.[1]

By PERCY W. COBB, Captain, M.C., Medical Research Laboratory,
Hazelhurst Field, Mineola, Long Island, N. Y.

(*With four figures in the text and one figure on Text-Plate XVI.*)

VISION under ordinary conditions and vision under extremely low intensity of light present quite different sets of phenomena. The latter phase of vision has heretofore been of interest from the diagnostic standpoint, and has been investigated and discussed as a problem in visual physiology.

This problem has related itself mainly to the demonstrable anatomic changes corresponding with exposure of the eyes to light or darkness, notably the presence or absence in the rods of the light-fugitive visual purple, the variations in the shape of the pigment cells and in the distribution of their pigment, and the possible shift in the position of the cones. Of these, the phenomena connected with the visual purple have been correlated with certain experimental changes in the vision of light and color characteristically related to the change between high and low light-levels, and have given rise to the theory of dual function. Stated briefly, this theory assumes that sensations of color are due entirely to changes resulting from the incidence of light on the visual cones. Colorless light-sensation mediated by the cones is also admitted; but sensitiveness to color is denied the rods which are held to give only light impressions undifferentiated in color, and to be capable of extreme enhancement in sensitiveness after a period of removal from strong

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[1] Presented by invitation before the American Ophthalmological Society, June, 1919.

Arch. of Ophthal., Vol. XLVIII., No. 5. *Text-Plate XVI.*

ILLUSTRATING DR. COBB'S ARTICLE ON "A CONTRIBUTION TO THE STUDY OF DARK-ADAPTATION."

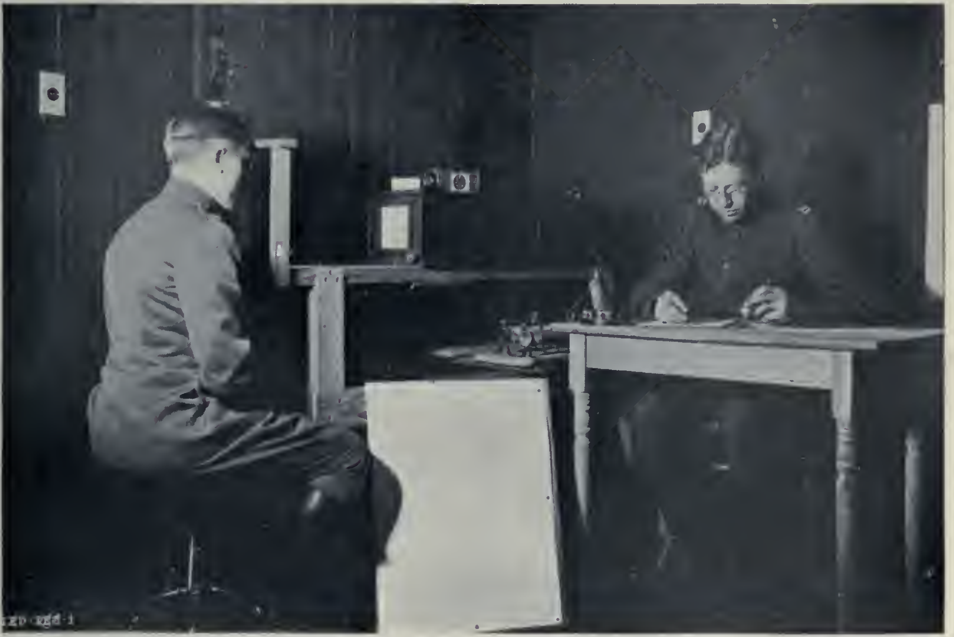

FIG. 1. General review of the experimental set-up. The test pattern appears on the square white surface at the end of the adaptometer. Above this is the fixation mark with dry cell attached. The white screen used for the purpose of "blinding" the subject is below in the foreground.

light. The changes in function that take place in normal vision in transition from high (daylight) to low (twilight or night) intensities of light can be enumerated briefly:

1. Color, as a visual quality, disappears. Objects are seen as lighter or darker, but not as of different colors.

2. Concomitantly a shift of sensitiveness, with relation to the position in the spectrum, takes place. The bright spectrum presents all the rainbow colors, and has its brightest part in the yellow. The dim spectrum is devoid of color. At its red end it has ceased even to be luminous, and its brightest point is found to be of shorter wave length (*i. e.*, farther towards what was the green) than the brightest part of the daylight spectrum.

3. An enormous enhancement of the absolute sensitiveness to light takes place. This is progressive and when measured is found to be rapid at first, then slower, and is found to become stationary in an hour's time or less.

It is the increasing sensitiveness of the darkened eyes, or dark-adaptation, which concerns us here. This phenomenon has long interested the student of visual physiology and has been investigated as a possible aid in the diagnosis of certain conditions involving the retina. Further than this it has not had technical importance.

In times of peace it is a simpler expedient to provide light than to try to see in the dark. The way of warfare is different, and to choose for the enemy unfavorable natural conditions which one has himself learned to meet is a part of good strategy. To orient himself with reference to terrestrial objects the aviator cannot depend upon hearing. The roar of his motor would make this impossible, even though otherwise he is not too far away. The experiment of feeling his way is unintentional because it is usually fatal. Both with respect to objects on the earth and to other airplanes the aviator must rely upon his vision alone. When night flying became a part of military strategy the classification of aviators on the basis of night vision became a problem worthy of study.

In attempting to find the lowest limit of light sensitiveness we at once encounter the fact that the light threshold is, apart from irregular variations, a variable quantity. The subject, taken into a dark room, at first requires an amount of light which is many times that necessary a few minutes later.

Exact researches have shown that the factor may easily be several thousand. In coming from bright daylight into the dark room the threshold has been shown in normal individuals to be 1500 to 8000 times that obtained an hour later, the subjects in the meantime remaining in the dark.

It has also been shown that the rate at which the threshold amount of light decreases is not always the same for the same individual, but depends upon the duration and intensity of the light to which the subject's eyes have been exposed during a (perhaps indefinite) period just prior to the experiment. The present work proposed investigating the quantitative relations regarding this last point, as well as determining the ultimate light-sensitivity of individuals and their characteristic mode and rate of recovery from the partial and temporary blinding due to light. The aim was to arrive at some idea of individual variations in these respects as preliminary to the devising of a practical and valid method of testing.

The detailed procedure used in conducting the experimental work at present under consideration will appear in another place. An outline of the essential facts will be given here.

The subject coming into the experimental room is seated facing the adaptometer (Fig. 1). On a level with his eyes, and 52*cm* away is a small red light dimmed as far as is consistent with certain fixation upon it in the dark. The test pattern is in the same vertical plane as the fixation point, its center 12*cm* directly below the latter. The test pattern is best described as a square, 7.5*cm* on each side, from which the middle third is removed, leaving two parallel rectangles, 7.5 x 2.5*cm*, with a dark space 2.5*cm* wide separating them. The center of the pattern is 13° below the point of fixation, and its extreme limits subtend about 8° horizontally and vertically in the visual field. This pattern is projected upon a sheet of milk glass, from the side away from the observer, by a device which is essentially a small stereopticon. The latter is enclosed in a light tight box, the milk glass being a window set in one end. The amount of light projected, and hence the brightness of the test pattern, was controlled and measured by means of a gelatine smoke wedge. The form of the pattern is determined by openings in a thin slip of brass, which represents the "slide" in the stereopticon. Two pairs of openings were used, one with the two rectangles in the vertical position, the other in the horizontal, and the change was made by a horizontal shift of the slide.

(1) As soon as possible after the subject entered the room the latter was darkened and his threshold was taken. This was repeated with approximately five-minute intervals of rest. In twenty or thirty minutes it was found that his threshold had reached a limit, and had become constant to within what could be called the margin of experimental error.

(2) When this was assured by the results, the first part of the experiment proper began, involving a measured amount of "blinding." A white screen was set up obliquely before the subject and the center light of the room was turned on. The screen subtended 67° vertically and 70° horizontally in his visual field, and its brightness averaged 13 candles per square meter. The subject was instructed to look at the central part of the screen, without especial effort to fixate. At the end of five minutes the light was turned off and the screen removed. In the meantime the test pattern had been set at a certain rather high level of brightness, and the time elapsing between the darkening of the room and the first visibility of the pattern was taken. After that the threshold was taken as before but with somewhat shorter intervals, until it had reached its former final value.

(3) When this had taken place the white screen was replaced and the procedure repeated as under (2), with fifteen seconds' exposure to the screen instead of five minutes.

This procedure was planned with the idea that the first portion would serve two purposes, to give a value for the absolute threshold of the subject and at the same time to bring him to a standard and reproducible state (that of complete dark-adaptation) before subjecting him to a standard amount of blinding. Obviously this latter would mean nothing unless the effects of previous light exposures had come to an end, and there seemed no way of making certain of this but to follow the subject's threshold to a constant value. There seems to be some evidence that even this, as done here, is not adequate. In two cases, the experimental order was varied, parts 2 and 3 of the experiment being transposed in order. Comparison of these results with the bulk of the results seemed to indicate that whichever stage (2 or 3) of the experiment was conducted last was subject to a residual effect from the blinding of the foregoing part, in spite of the fact that the subject had, in the meantime, come back to his first ultimate threshold. This was evidenced by a somewhat more rapid recovery in these two cases than was to be expected in part 3 when this took second place in order, and by a slower recovery in part 2 when this took third place.

A study of the results yielded a set of numerical values which are summarized in Table I. From this it will be seen that the individual variations are quite large, on every point. For example, in different individuals the absolute threshold was found as high as 9.95 and as low as 1.34 millionths of one candle per square meter. The mean value for all subjects was 4.97 with a mean deviation of 2.18 millionths or 44 per cent. of the mean.

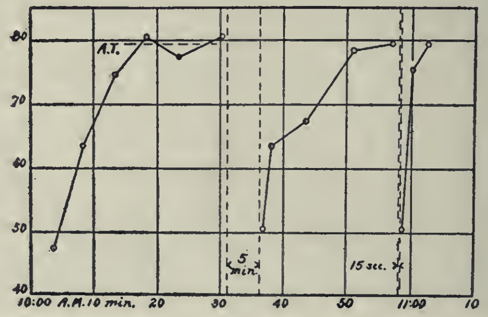

FIG. 2

A specimen of the course of adaptation is shown graphically in Fig. 2, the three curves being the graphs of parts 1, 2, and 3 of the experiment, as described, and the intervals of measured blinding being indicated by the vertical dotted lines. The ordinates of the plot indicate the position of the wedge, by which the intensity of the light was cut down. The relation between the shift of the wedge and the brightness of the test-pattern is a logarithmic one, such that the brightness is reduced by a constant fraction for equal linear shifts of the wedge. With the wedge at 0.0*mm* the brightness is 0.0272 candles per square meter, which is in effect divided by 2.79 for each 10*mm* shift of the wedge. The relation between these readings in millimeters, and the actual brightness of the test pattern, in decimals of one candle per square meter, is shown by the comparative scale of ordinates in Fig. 5. The decimal scale alone appears in Fig. 4, and in these two figures the horizontal lines indicate the intervals of a tenfold change in brightness.

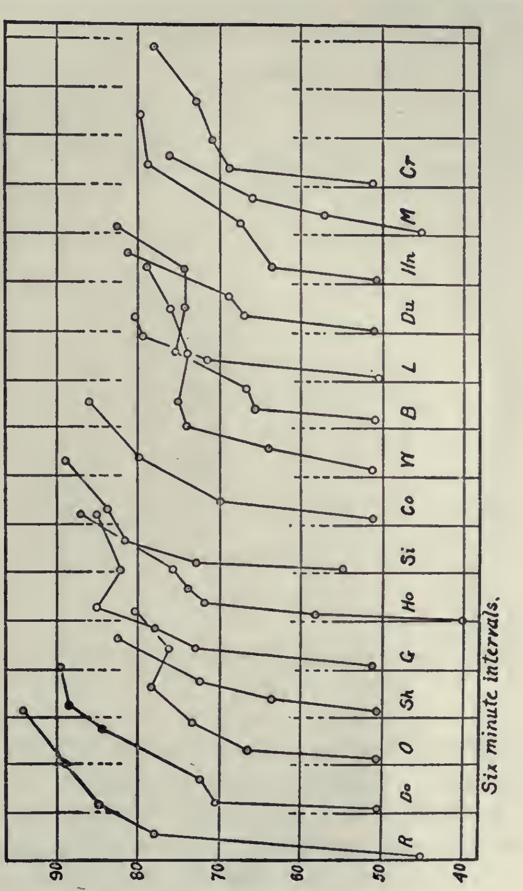

FIG. 3

Returning to Fig. 2, the absolute threshold is indicated at the height of the first curve by a horizontal dotted line. It is placed at the mean of the three points indicated. The relation between amount of blinding and the rate and mode of recovery appears from consideration of the next two curves. For a blinding period of five minutes the curves show characteristic differences as exhibited in Fig. 3; where the results for all fifteen subjects are plotted for comparison. These show the various heights of sensitiveness which different individuals ultimately reach, and also show in certain cases quite definite temporary arrests in the progress of adaptation (Do, B, Du, Hn, Fig. 3). Out of a total of fifty-two adaptation-curves plotted, fourteen showed this halt in the rise of sensitiveness very definitely, while in four others it is suggested. To emphasize this the first two curves shown in Fig. 3 are plotted together in Fig. 4, with their common origin at the point where adaptation begins and with the time-scale enlarged fourfold.

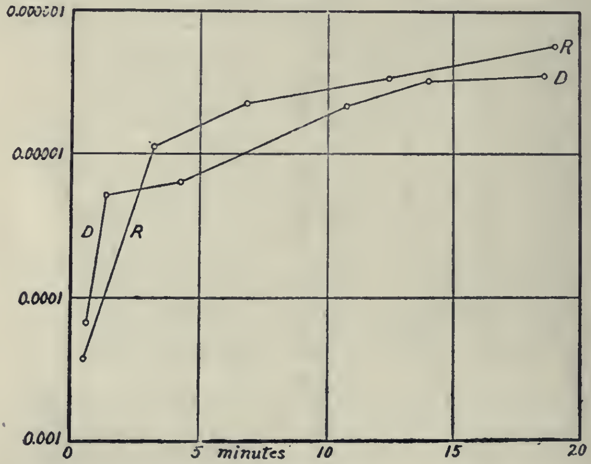

FIG. 4

In considering the rate of adaptation, that is, the individual rate of recovery of the sensitiveness temporarily lost in the process of blinding, it is to be said that great variation was found, but the most interesting fact is that the time of return to a fixed point in the scale of sensitivity (estimated from the plotted curve) bears no very definite relation to the ultimate degree of sensitiveness which the individual may show. There is perhaps a general trend, as might be expected, in the sense that a subject with a low absolute threshold reaches a given level of sensitivity more quickly and *vice versa*, but the exceptions to this are more noteworthy than the rule. In Fig. 5 are plotted the results from four types illustrating this. Subjects R and Si have low absolute thresholds (high sensitivity), but R is slow and Si rapid in recovery. Similarly in the cases of W and Cr

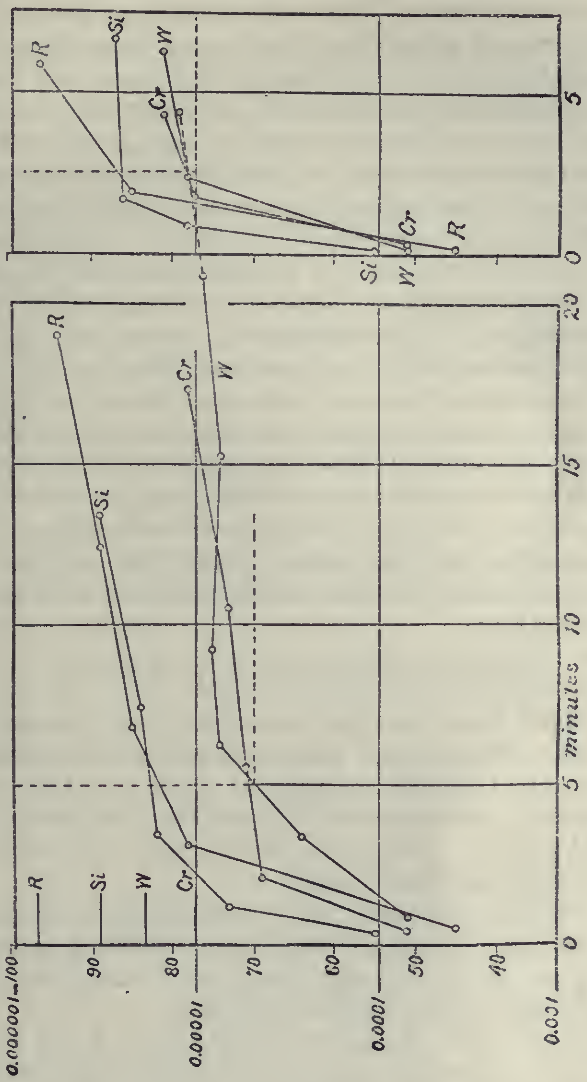

FIG. 5

whose absolute thresholds are, however, high. By examining the steep parts of the curves it will be noted that Cr at first re-covers more rapidly than R, who is by far the more sensitive later on in the course of adaptation.

As to the general difference in the rate of recovery, as dependent upon the duration of the previous blinding, it is to be said that recovery is about three times as fast following the fifteen seconds' blinding as it is following the five minutes' blinding. The course is shown graphically in the right hand plot, Fig. 5, for the same four subjects. Owing to the rapidity of recovery the data are not as explicit as in the case of slower recovery.

The study of dark adaptation with reference to the practical use of the eyes at night involves a point of view different from that involved in the study of dark adaptation for the purpose of solving physiologic or diagnostic problems, and a question arises here, with especial reference to the aviator. In rating him, shall we consider his ultimate sensitivity, or shall we rate him in the basis of his speed of recovery after blinding? In other words, from this standpoint, which portion of the curve deserves the more exhaustive investigation? It would seem an obvious answer to this to say that the part of the curve to investigate is that which, in general, best represents the illumination conditions existing under natural light at night. The photometric study of such conditions will be a relevant and interesting topic.

SUMMARY OF EXPERIMENTAL CONCLUSIONS.

(1) Upon investigation of fifteen subjects, it appears that the limit of vision in dark-adaptation (the absolute threshold), measured by the least brightness at which gross form may be recognized, is variable within extreme limits expressed by the ratio of 7.4 to 1. These limits lie between 1 and 10 millionths of one candle per square meter.

(2) The rate of recovery, after dark adaptation is disturbed by a standard exposure to light, is also variable as between individuals, and by no means always in a sense corresponding with the value of the absolute threshold.

(3) Recovery to the point of visibility of a test stimulus 4.7 times the individual's absolute threshold is in general slower, the lower the absolute threshold. This seems to be the consequence of the simple fact that the test stimulus, so chosen, is necessarily the farther below the level of brightness of the

blinding surface, the lower the absolute threshold. The extreme individual variations in time for this relative degree of recovery are as 4.5 to 1, and as 2.5 to 1 for five minutes and fifteen seconds respectively.

(4) The time of recovery to the point of distinguishing a test object of standard brightness is to be looked upon as a function of two variables; the individual's absolute threshold and his rate of recovery as indicated under (3). For a constant test stimulus 4.7 times the (geometric) mean absolute threshold of all subjects, the extreme variations in time are expressed as 8.7 to 1, and 2.75 to 1 for the longer and shorter blinding periods respectively.

(5) The times of recovery are less diverse after a short blinding (15 seconds at 13 candles per square meter) than after a longer one (5 minutes, same), and in the former case recovery takes place on the average in about one third the time, or probably less when all antecedent conditions are equalized.

(6) The occurrence, in the course of dark-adaptation, of more or less definite arrests in the increase of sensitivity suggests the independent working of two physiologic mechanisms. These halts occur more or less definitely in eighteen out of fifty-two curves studied, and appear, when distinct, as "terraces" on the rising slope of the curve.

(7) The practical usefulness of data, such as the present, will depend upon a definite photometric knowledge of the minimum light-conditions under which the subject may be called upon to use his vision.

TABLE I.

	Absolute Threshold	AT − 15mm.		70mm.		50mm. ±	
		Recovery time, seconds, after blinding for					
		5 min.	*15 sec.*	*5 min.*	*15 sec.*	*5 min.*	*15 sec.*
Largest value	9.95	385	106	542	99	62	25
Smallest value	1.34	86	43	62	36	10	5
Mean	4.97	214	71	233	73	34	12.6
Mean deviation	2.18	78	16	103	12	11	4.4

GENERAL RESULTS OF THE DARK-ADAPTATION EXPERIMENTS.

The absolute threshold is stated in millionths of one candle per square meter.

The next two columns give times of recovery, in seconds, of sensitivity corresponding to 4.67 times the subject's absolute threshold (AT−15*mm*), for the five minutes and for the fifteen seconds' periods of blinding respectively.

Similarly, the next two columns (70*mm*) give the times of recovery to the point of visibility of a stimulus 4.67 times the (geometric) mean absolute threshold. This is 4.33 x 4.67 = 20.4 millionths, represented by 70*mm* in scale.

Under "50*mm*±," correspondingly, the times of recovery to a threshold of about 159 millionths, the initial result of parts 2 and 3 of the experiment as described in the text.

The times given under "AT−15*mm*" and under "70*mm*" were estimated from the plotted curves, such as Figs. 4 and 5.

THE MADDOX ROD SCREEN TEST.[1]

By Captain PERE DOLMAN, M.C., Medical Research Laboratory,
Hazelhurst Field, Mineola, Long Island, N. Y.

INTRODUCTION.

IT has been said by Colonel W. H. Wilmer, who established the Ophthalmological Department of the Medical Research Laboratory at Mineola, that the safety of the flier depends more upon good extraocular muscle function than upon good visual acuity. Under the stress and fatigue of flying, the aviator with hyperphoria or a divergence excess is apt to have his error become manifest as a diplopia which would make a safe landing nearly impossible. The symptoms (1) of headache, vertigo, and nausea, which commonly accompany some of the disturbances of motility of the eye are not compatible with the efficient service that is expected from the man who flies. For these reasons, the examination of the extraocular muscles must be conducted with the greatest care in the Air Service in order to uncover any defect which might jeopardize the life of the aviator.

During the past year several tests for the detection of heterophoria in the primary position were approved by the Ophthalmological Department of the Medical Research Laboratory. All of these except the Maddox rod screen and parallax tests were finally eliminated in an effort to reduce the ophthalmological equipment to a compact war basis. In the course of the examination of hundreds of men, the Maddox rod test, because of its great simplicity and easy application, was established in a favored position to the partial exclusion of the other tests.

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[1] Presented by invitation before the American Ophthalmological Society, June, 1919.

At this stage of the laboratory work, several of the examining surgeons began to question the accuracy of the Maddox rod test. The evidence submitted by them showed that some aviators could not see the light and the line at the same time; that others saw the line of light moving about so erratically that no measurements could be taken; that still others showed a tendency to fuse the line with the light, indicating orthophoria when some form of heterophoria was known to be the true condition.

CRITICISMS OF THE MADDOX ROD TEST.

A review of American ophthalmic literature reveals many criticisms of the Maddox rod test which support these observations. Duane (4), in discussing the routine examination of the eye, says that the test is not as reliable in his hands nor as accurate as the screen and parallax tests. He finds it is apt to indicate an excess of esophoria and a tendency in some patients to fuse the line with the light. Later (5), he repeats this criticism and estimates the amount of excessive esophoria shown by the test to be about one degree. Howe (7), in his elaborate study of the eye muscles, places the Maddox rod third in the list of tests arranged according to their clinical value. In analyzing some tests for heterophoria, Stevens (11) finds that the tendency of the line to fuse with the light is so great that orthophoria is often shown when heterophoria exists. Weeks (13) calls attention to the fact that some patients have difficulty in seeing the line of light. On the basis of some comparative tests, Weymouth (14) concludes that the Maddox rod showed an excessive amount of esophoria.

In spite of all this authoritative criticism of the test, the Maddox rod continues in general use. It is to be found in almost every trial case and is included in the equipment of most of the new combined phorometers. When we consider that studies of heterophoria, based wholly or in part on this test (3, 10), are being added constantly to our ophthalmic literature, it becomes a matter of importance to determine its accuracy. This experimental work was begun for the purpose of investigating these criticisms of the Maddox rod test, analyzing the causes back of them and suggesting, if possible, some remedial procedure.

CONTROL TESTS, OBSERVERS, AND APPARATUS.

The screen and parallax tests, recommended by Duane, were used as control tests. The observers were chiefly aviators with normal visual acuity and normal-functioning ocular muscles. The apparatus used was DeZeng phorometer-trial frame, equipped with a pair of Maddox rods and a pair of Risley rotary prisms. The spot of light was obtained from a frosted Mazda lamp surrounded by an opaque chimney. An iris diaphragm in the chimney permitted the size of the spot to be regulated. This lamp was mounted on a movable floor standard, which could be adjusted for height. The tests were made with the eyes in the primary position looking at the light twenty feet away. For the purpose of some experiments, a condition of artificial heterophoria was produced by placing a trial case prism in the trial frame of the phorometer. This prism was always placed before the eye that was covered by the Maddox rod. When necessary to study the effect of reduced visual acuity, convex lenses were placed before one or both eyes. The effect of accommodation on the test was studied by placing concave lenses before one or both eyes. In the following report "the light" or "the spot of light" refers to the light twenty feet away at which the observer looked during the test; "the line" or "the line of light" refers to the line of light seen by the observer when looking through the Maddox rod.

SCOPE OF THE INVESTIGATION.

For the purpose of study, the criticisms of the Maddox rod test were grouped under four heads:

I. Excessive esophoria.
II. Fusion tendency.
III. Instability of the line.
IV. Inability to see the line.

I. *Excessive Esophoria.*—One hundred men were examined for the purpose of determining if the Maddox rod test does actually show more esophoria than the screen and parallax tests, which were employed as controls. An analysis of the result of the examination gives seventy-two men who have ½ to 2 prism diopters more esophoria or less exophoria by the Maddox rod test than by the control tests.

This fact being established, a study of the various factors entering into the test was made for the purpose of discovering the possible causes of the excessive esophoria. The factors were gradually eliminated by experiment until the following two remained:

1. Latent hypermetropia.
2. False projection of the line.

1. *Latent Hypermetropia.*—A group of emmetropes, free from heterophoria, was selected for the purpose of determining the effect of artificial hypermetropia on the Maddox rod test. With the Maddox rod in place before one eye, a one diopter concave lens was placed before the other eye. The test registered esophoria immediately, showing that the light-fixing eye, which was covered by the lens, controlled the finding. On removing the lens the test showed orthophoria. On placing it before the eye covered by the Maddox rod, the test still registered orthophoria, showing that the light-fixing eye still controlled the finding. With the lens still in place before the eye covered by the Maddox rod, the observer was urged to concentrate his attention upon a line and disregard the light. After considerable effort he was able to focus the line through the concave lens and the test registered esophoria immediately. The accommodative effort necessary to do this, however, was so much greater than the effort necessary for light fixation that at the first wavering of attention from the line, the light was again fixed and the test showed orthophoria. The addition of a great variety of lenses to one or both eyes of the observers used in this experiment confirms the conclusion that a hypermetropic condition of the light fixing eye, by stimulating accommodation and convergence, always effects the findings of the test in favor of esophoria. A hypermetropic condition of the eye covered by the Maddox rod does not influence the result of the test unless fixation is switched from the light to the line.

Attention is now called to the fact that persons with unequal, uncorrected hypermetropia usually use the eye with the lesser refractive error for the purpose of clearest vision. If this eye with the lesser amount of hypermetropia be covered by the Maddox rod, the result of the test will be based upon the greater amount of hypermetropia in the light fixing eye. Such a finding will show more esophoria than actually exists.

The experiment emphasizes the necessity of having the patient wear his refractive correction during the test for heterophoria.

2. *False Projection of the Line.*—Some observers apparently see the line of light nearer than the source of light twenty feet away. On being questioned they are apt to say that the line passes in front of the light. The recorded answers of fifty observers show that not one thought the line was as far away as the light. Some saw the line a few inches from the face. The majority projected it from three to ten feet away. It is not possible for an observer to give close attention to an image which he believes is ten feet away without making some effort to focus his eyes for that distance. Peterson (9), in analyzing a distant light phenomenon, says, "Normally in spatial perception our focus is on the object which received the attention." If the observer visualizes the line nearer than twenty feet and focuses upon it where he imagines it to be, the accommodative effort he makes produces a convergence which in turn increases the amount of esophoria.

The experiments made in studying the false projection of the line indicate that it is more apt to occur if the line is seen indistinctly. A reduced visual acuity, for example, causes the observer to try to bring the line into sharp focus, which results in esophoria if he is able to make any accommodative effort. An indistinct line, caused by irregularities in the surface of the glass of the Maddox rod, produces the same effect. A large number of Maddox rods have been tested for such defects and for prism. A separate report will be made on these defective rods.

The natural precaution to be taken against false projection of the line is to keep the observer's attention fixed on the light as completely as possible during the test.

II. *Fusion Tendency.*—There are little data available on the subject of the fusion of more or less dissimilar retinal images. It is not known how dissimilar the two retinal images must be in form, color, and distinctness to prevent fusion. In addition, I can find no record of any experimental work done on the fusion tendency as distinguished from actual fusion.

The present investigation has determined that the spot of light and the line projected by the Maddox rod form retinal images, sufficiently dissimilar in form to prevent actual fusion in the measurement of esophoria and exophoria. An apparent fusion in the measurement of hyperphoria is shown in a number of the tests.

It has been demonstrated by the experiments that the fusion tendency is increased by certain conditions which may surround the Maddox rod test. They are:

1. The exclusion of extraneous retinal images.
2. Horizontal and vertical lines in the background.
3. Additional sources of light.
4. Intensity of the point of light.

1. *The Exclusion of Extraneous Retinal Images.*—When the room, in which the test is being made, is darkened so completely that the light and the line are the only two outstanding sources of retinal stimulation, the fusion tendency is very strong. The light and the line are double images in the truest sense, causing confusion and interfering with vision. The natural reaction of the observer to this unusual condition is to avoid the double images, by an attempt at union or fusion (6).

When the room is not darkened during the test, the eye fixing the spot of light is diverted by the extraneous images of numerous objects and outlines in the background. The line and the light now of lessened brilliancy, are no longer the only sources of retinal stimulation and the fusion tendency is decreased. Exceptions to this conclusion are considered under the next two captions.

2. *Horizontal and Vertical Lines in the Background.*—The line of light fuses readily with horizontal and vertical lines situated near the point of light (12). The vertical lines of door and window casings, cabinet edges, etc., even when situated twelve inches or more away from the spot of light, may be fused with the line of light. The most vicious of these lines is the one projected by the vertical standard made to support

the lamp used in the test. This form of light equipment, which is manufactured particularly for the purpose of ocular tests, has escaped general suspicion. One was in use in this laboratory for several months before attention was directed to this inherent fault and its construction.

3. *Additional Sources of Light.*—The spot of light arranged for the purpose of the test should be the only source of illumination visible to the observer. Other sources of illumination, such as overhead lights, table lamps, and partially shaded windows, are seen through the Maddox rod as supernumerary lines of light, any one of which may be fused with the spot of light and give a false finding.

4. *Intensity of the Point of Light.*—When the spot of light is very brilliant, an intensely bright line is formed and the fusion tendency is then greatly increased. This is particularly true where the room in which the test is conducted is dark. A spot of light of very moderate intensity is sufficient for the purposes of the test in a semi-darkened room.

The effort to see the line and the light simultaneously naturally stimulates the fusion tendency. When the observer concentrates his attention upon the light and disregards the line as much as possible, no movement of the two images takes place to indicate a fusion tendency. The same is true when the observer's attention is concentrated upon the line to the exclusion of the light.

III. *Instability of the Line.*—In the Maddox rod test for esophoria and exophoria, the line is frequently observed to lack stability. Instead of being in a fixed position in the background, it is seen in a constantly varying lateral relation to the light. Patients speak of this phenomenon as a "wavering" or "dancing" of the line. A similar movement of the light is merely observed. This is due to the fact that the light is seen in its proper relation to other objects in the room. The eye covered by the Maddox rod, however, sees no objects in the room which help to give the line a fixed position. For this reason, any change in the lateral distance between the light and the line is interpreted as a movement of the line alone.

The experimental study of this phenomenon demonstrated that the movement was checked when the observer concentrated his attention and fixation on the light and at the same time disregarded as much as possible the image of the line. Similarly, the movement was checked when the line was fixed and the image of the light disregarded. It follows from these facts that movement of the line may result from an effort to fix both the light and the line at the same time or as a result of fixation which alternates between the light and the line.

In simultaneous fixation the movement may be due to:

The fusion tendency.

In alternating fixation it may be due to:

1. Unequal hypermetropia.
2. False projection of the line.

The influence of these factors on the test has already been discussed so completely that their relation to instability of the line is apparent.

The data collected in this investigation indicate that another cause of movement of the line may be connected with the habitual use of one eye for fixation purposes. This phase of the investigation will be made the subject of a separate report.

IV. *Inability to See the Line.*—The causes of failure to see the line in the Maddox rod test are usually simple and self-evident. They are reviewed here chiefly for the purpose of completing this critical study of the test. They may be grouped as follows:

1. Malposition of the Maddox rod.
2. Bright illumination of the room.
3. Dimness of the spot of light.
4. Non-essential sources of light.
5. Poor vision in one eye.
6. Habitual suppression of one image.
7. Poor vision in both eyes.

1. *Malposition of the Maddox Rod.*—The single Maddox rod must be very carefully adjusted in front of the eye to bring the line in the field of vision. Some of the newer multiple rods, because of their small diameter, require unusual care in adjustment. A more distinct line is always secured when the rod is placed close to the eye.

2. *Bright Illumination of the Room.*—If the test is made in a brightly lighted room, the line is not easily seen in contrast with the surroundings. In a very dark room both the light

and the line are seen more distinctly but the manipulation of the apparatus is accomplished with unnecessary difficulty. The test is best made in a semi-darkened room.

3. *Dimness of the Spot of Light.*—A bright source of light, diffused by ground or milk glass, is most suitable for the test. Such a light, when screened down to a diameter of from 8 to 10*mm*, will irritate the eyes very little and will be seen through the Maddox rod as a line bright enough to be distinguished easily in a semi-darkened room.

4. *Non-essential Sources of Light.*—When sources of light, non-essential to the test, are located in front of the patient, several lines of light may be seen through the Maddox rod. The particular line belonging to the spot of light often is not located under these conditions and the test is completed with the wrong line.

5. *Poor Vision in One Eye.*—The eye covered by the Maddox rod may have such poor vision that the line cannot be seen distinctly. The obvious remedy is to place the rod before the better seeing eye.

6. *Habitual Suppression of One Image.*—When the image of the non-fixing eye is habitually suppressed, the Maddox rod test fails because the test depends upon the relation between two images which must be seen at the same time.

7. *Poor Vision in both Eyes.*—When the visual acuity of both eyes is greatly reduced, the test may fail entirely because neither eye, when covered by the Maddox rod, can see the line distinctly.

While this experimental study was in progress, the data collected from day to day were analyzed for the purpose of discovering some common cause of the excessive esophoria, the fusion tendency, and the instability of the line, which constitute the chief criticisms of the Maddox rod test. The conclusion was reached that these faults depend chiefly upon the effort of the observer to fix both the light and the line at the same time or to alternate his fixation between them. It was but another step to apply the screen to the test as a means of controlling the observer's fixation. The use of the screen to cover the eyes alternately, as in the screen and parallax tests, obviously would not help here because alternate fixation was causing part of the error. The choice then lay between permitting the observer to fix the light or to fix the line during the test. Line-fixation was regarded as objectionable because it induced false projection in some cases. It seemed better to consider the line as a false image, the position of which was to be determined in relation to the light. This view of the test definitely gave the rôle of fixation to the eye which sees the light and directed that the screen be used to prevent line-fixation.

I am able to find but one reference to the use of a cover in connection with the Maddox rod test (4). No originality is claimed for the general idea, but the technique of the test, as worked out in the laboratory, is probably sufficiently new to warrant a detailed description of the procedure.

THE MADDOX ROD SCREEN TEST.

(*At Six Meters.*)

The observer is seated facing the light, which is at the height of his eyes and six meters distant. The Maddox rod may be held in position by a trial frame and the measurements made with square prisms or those found in the trial case. The test is much simplified and greatly facilitated by the use of a modern phorometer-trial frame, equipped with a double multiple Maddox rod and a double Risley rotary prism. This apparatus is brought closely in front of the observer's eyes and adjusted to a horizontal position by means of the spirit level. The phorometer is not used to measure the amount of heterophoria because its binocular prisms deflect the visual axes of both eyes and consequently leave neither one in the primary position. Both the Maddox rod and the rotary prism are swung into position before one eye, allowing the other an unobstructed view of the light. It is a good idea to set the rotary prism 4 △ or 5 △ off the zero mark in order to deflect the line at the beginning of the test. This will serve to expose any one who has been coached to say that the line passes through the light.

A card about 6 x 9*cm* is used as a screen. This is moved from one eye to the other a few times to ascertain if the observer sees both the line and the light. If the line is not seen readily, the Maddox rod is readjusted by centering it carefully in front of the pupil. Some further darkening of the room may be necessary to render it visible.

When the observer sees both the line and the light easily, the test is begun by holding the screen in front of the Maddox rod to shut out the image of the line. The observer now sees only the light. After he has fixed it for several seconds, the screen is removed for an instant and quickly replaced. In that brief interval the observer should see the line and be able to locate it with reference to the light. After one or two brief exposures, he will be able to say in a test for lateral imbalance that the line is to the right or left of the light or possibly through it. He is then instructed to grasp the milled head that rotates the prism and turn it to bring the line directly through the light. To enable him to do this, the screen should be removed from the eye at intervals and quickly replaced. Finally the observer will have rotated the prism enough to cause the line to pass through the light every time he sees it when the screen is removed. The number of prism diopters necessary to deflect the line through the light is read from the scale of the rotary prism.

The results of the test will be more accurate if the eye that fixes the light is in the primary position and not deflected from it by a prism. It is for this reason that the measuring prism is placed always before the eye that is covered by the Maddox rod. The Risley rotary prism is convenient because it enables the observer to make the necessary prism correction himself.

Attention is called to certain merits of the procedure described. One eye is permitted to fix the light while all vision of the line by the other eye is prevented except for brief intervals. The eye under cover takes a position that is influenced by a minimum of the innervation habitually required for binocular vision (2, 8). The removal of the screen can be done so rapidly that the image of the line fails to stimulate the retina enough to cause readjustment of the visual axes in the interest of binocular vision, yet the exposure is long enough to permit the line to be seen for the purpose of the test.

The test offers one very interesting variation. Either the right or the left eye may be selected to fix the light. Each individual can thus be tested in two ways and two sets of measurements be obtained. The variation in these double findings and the relation of the "sighting" or "dominant" eye to the test are being studied and will be made the subject of a later report.

Experiments lasting several months demonstrate that this test is more accurate than the accepted Maddox rod test. The results obtained with it are identical with those of the screen and parallax tests. This high degree of accuracy, combined with the simplicity and rapidity of application of the test, has caused its adoption by the Medical Research Laboratory.

CONCLUSIONS.

1. The Maddox rod test, because of its easy application and the simple nature of the observation required, enjoys a popularity and widespread use among ophthalmologists.
2. Studies of heterophoria, based wholly or in part on Maddox rod findings, are constantly being reported in ophthalmic literature in spite of some serious criticisms of the test.
3. The test has been condemned chiefly because it shows excessive esophoria, a tendency to fusion, and an instability of the line of light.
4. These faults of the test have been verified and the underlying causes determined.
5. The Maddox rod screen test, a simple modification of the usual procedure, gives results that are accurate and free from the above criticisms.

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REPORT OF THE ANNUAL CONGRESS OF THE OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM.

By Mr. H. DICKINSON, London.

The Society held its Annual Congress in London on May 1st, 2d, and 3d, under the presidency of Mr. J. B. Story (Dublin).

The President expressed his high appreciation of the honor conferred upon him by his colleagues in electing him to fill the chair of the Congress. The Society, he said, was much indebted to its past-presidents, and to none more than Mr. Treacher Collins, who steered the barque of their fortunes through the stormy weather of the last years of war: it was largely due to him that the last Congress was such a success. On that occasion the discussion on plastic surgery of the eyelids excited very great interest, and the exhibition of cases, photographs, and casts made a deep impression on those privileged to attend the meeting, or who visited the Plastic Hospital at Sidcup. The same subject had been chosen by the Bowman Lecturer this year, Professor Morax. The discussion also on contagious diseases of the conjunctiva, held at Swanley, was also a pleasant and important feature of last year's Congress. He also expressed satisfaction that the Oxford Ophthalmological Society and the Midland Ophthalmological Society had become affiliated with the larger body. He was now happy to state that three other societies had now been affiliated: the North of England, the Egyptian, and the Irish. Among the deaths during the past year, he wished to specially mention four, two of them original members—Dr. John Cooper and Dr. Thomas Buzzard; Mr. Devereux Marshall, who died in Bombay on active service, of cholera. He believed Mr.

Marshall was at one time Secretary of the Society, and he had served on its Council. Another whose name he would mention was Sir James Mackenzie Davidson, whose work on the localization of foreign bodies in the eye by means of X-rays was familiar to all. He concluded by a reference to the special subjects for discussion at the present Congress.

On the initiative of Sir Anderson Critchett, the President was cordially thanked for his address.

Mr. TREACHER COLLINS read a paper on **abiotrophy of the retinal neuro-epithelium,** or **retinitis pigmentosa.** He pointed out that the pathological examination of several eyes with retinitis pigmentosa had shown that the affection might occur without sclerosis of the choroidal blood vessels, and that the primary change appeared to be a degeneration of the rods and cones. As the condition is hereditary, he suggested that the degeneration might most aptly be described as an abiotrophy. From this standpoint, its various accompaniments might be explained as follows: The increase in the neuroglia of the retina is similar to that met with in various forms of neuronic abiotrophy, and not like what occurs in sclerosis where there is an increased firmness in consistency. Secondly, the pigmentation of the retina is caused by the degeneration of the rods and cones together with their attached nuclei, leaving spaces in the membrana limitans externa, through which the pigment epithelial cells, or their pigment granules, can migrate. Such migration he considered was probably due to the physiological capacity for movement in the direction of light which these cells and granules possess. The light-colored dots sometimes seen in the retina, and the hyaline nodules occasionally met with on the optic disk, are of the same nature, and are due to hyaline degeneration of cells derived from the outer layer of the secondary optic vesicle, from the pigment epithelium overlying the choroid, and the neuroglia in the optic papilla. In typical cases the degeneration of the neuro-epithelium commences where it is first fully developed, *i.e.*, around the macula, which, being last developed, is last involved. This is why sight begins to fail in the form of a ring scotoma. Night-blindness, the earliest symptom, is due to the failure of vision commencing in the part of the retina which, in the dark-adapted eye, is the most sensitive to light, that is 10° to 20° from the fovea. Atypical cases of retinitis pigmentosa occur in which the macula alone is involved. There being no blood vessels at the macula, there are, in these cases, no branching pigment patches, only scattered dots and granules of pigment. The deafness and affections of the nervous system met with in association with retinitis pigmentosa are also due to abiotrophy.

Professor HERBERT PARSONS remarked on the danger of labeling a diseased condition with a particular term, and considering that this explained it: even if it were an abiotrophy, one had to get behind that and try to ascertain the causation. He did not think it would be difficult to oppose arguments to each thesis set up by the author, if there were time.

Sir ANDERSON CRITCHETT spoke of the way subjects of retinitis pigmentosa were helped by wearing yellow glasses. He asked whether members had had experience of Crooks glasses (which take out the purple rays) for this condition. The subject was also discussed by Mr. R. GREEVES and Mr. M. S. MAYOU.

Mr. GEORGE YOUNG read a paper on **results of double sclerectomy operation for glaucoma.** The paper was founded on twelve cases. The reduction in tension had been, so far, permanent; there had been no bad results over periods of several months to two years. The incision must be as near the limbus as possible, and he emphasized the necessity of making a second opening. It was not disfiguring and there were no relapses.

The PRESIDENT considered the operation easy compared with other procedures.

Lieut.-Colonel HERBERT contributed a paper on **the future glaucoma operation.** He said that in India cases of glaucoma were always far advanced when seen, and he had been driven back to the iris prolapse operation. An incision was made by puncture and counter-puncture, with a 1*mm* Graefe knife; the incision was entirely subconjunctival. In advanced glaucoma the incision could be safely made of almost any size. This operation was free from the disasters which might attend iridectomy for the condition. The whole operation could be performed without emptying the anterior chamber, and its chief feature was the sufficient widening of the filtration area. He described the technique in minute detail.

Mr. R. R. CRUISE read a paper on **contracted sockets,** in which he described a procedure to enable a socket which had been disorganized by injury to hold a glass eye.

Mr. C. HIGGENS showed a number of soldiers on whom he had performed various operations for the same purpose, and demonstrated the procedure followed in each case.

Mr. W. SINCLAIR discussed **eye complications in cerebrospinal meningitis,** and Mr. PERCIVAL J. HAY read a paper describing some new test-types.

Discussion on Visual Requirements of Aviators.

On Thursday afternoon members assembled at the Psychological Laboratory, University College, where a discussion was held on the subject of **visual requirements of aviators.** Professor SPEARMAN delivered an address on stereoscopic vision, which had been decided by many people, including Americans, to be the most important factor in the visual fitness of aviators, especially in regard to successful landings, a source of much mortality among fliers. He divided his remarks into (1) a method of testing stereoscopic vision in candidates, (2) suggestions as to means of improving the vision of aviators. This faculty had to be differentiated from quasi-stereopsis or the power of appreciating depth, and which depended on the clues at the disposal of either eye alone. In stereoscopic vision, each eye had to form a good image, and that depended, principally, on the optical excellence of the iris. It seemed to be considered that for binocular vision all that was required was for both eyes to function, instead of only one. But there was only one visual field in consciousness, though there were two ocular fields, and both ocular and conscious fields could not function with regard to the same spot at the same time. It was seldom that both eyes acted simultaneously; that was sometimes due to asymmetrical astigmatism. It was important to try to find out how the ocular movements tested the balance of muscles. The eyes took up the right position for clear-seeing if given plenty of time, but it did not necessarily follow that they would do so when speed was essential. A test embracing the following of a moving field was therefore necessary.

Mr. A. R. BRAILEY tabulated his results in the ocular examination of about four thousand candidates for the Air Service. The visual standard was, at first, very high, but later it was somewhat relaxed, and the fitting of lenses to the flying masks was permitted, and they proved quite satisfactory. Some officers asked for a difference in the shape, and others requested tinted glasses on account of glare. The lowest vision permitted was $\frac{6}{18}$ with the better eye, $\frac{6}{24}$ with the worse, corrected by glasses to $\frac{6}{6}$ and $\frac{6}{9}$ respectively. Binocular vision and a good sense of perspective were not always found to go together. No rejections were made on account of faults of muscle balance, apart from actual squint. Flying failures were not found to be more numerous among the wearers of glasses than among others. Perception of the parallactic movement of objects he regarded as the all-important factor, but this he had found it difficult to assess by any test. When making a landing at a high speed, it was difficult to see the details of objects, and in that operation he did not think stereoscopic vision could be of great assistance in that. Little could be done in the way of correction of muscle defects by any form of training, however continuously carried out. Before candidates were accepted, details of their heterophoria should be available, both before and after treatment. For this Service, a more important matter than acuity of vision in itself was the precision and rapidity of coördination between eye and brain: it was useless for a man to see perfectly unless he could accurately interpret, and act quickly in accordance with his perception. Fliers could not be selected by medical examination alone, any more than an efficient cricket team could be so selected from among the boys in a school: in flying, pluck, resource, and response to stimuli were more important than medical perfection, especially in war time. Still, medical examination was important in regard to stress and fatigue, especially at high altitudes. Standards of light and color sensibility should be set up, so that parents could know, years beforehand, whether their sons were likely to attain to them. One very successful flying man in the Service had 5 D. of myopia in each eye, and—probably as a result of wearing glasses—he had but indifferent binocular vision. A too stringent standard would exclude many otherwise desirable men.

Major CLEMENTS said 26% of the men who came under his observation had glasses ordered, and they were turned down on account of bad landings. He described in detail the tests he employed, and the results obtained. Of 294 men, 60% who were rejected on account of having made bad landings had been in clerical or other close occupations. He had much of interest to say as to actual flying: the way in which the aviator knew whether he was flying level, and demonstrated the importance of good peripheral perception. The good flier looked at his horizon and used the nose of the machine as a protractor for measuring the flying angle.

Professor J. H. PARSONS spoke of the need of research in this matter, of which the work done by Professor Spearman was a good example. This was the more needed on account of the already large amount of literature on the subject, too large a proportion of which was merely speculative. One of these important questions was that of heterophoria, and researches on the subjects coming within the scope of the present discussion should be against controls, as was the case in any well-conducted scientific inquiry.

Mr. ERNEST CLARKE spoke of the importance of testing under hom-atropine in every case in order to exclude latent hypermetropia. Nearly all the men he had examined because they had crashed had hypermetropic astigmatism, but they had been passed as what was termed "practically normal."

Colonel FLACK referred to the large range of capacity in candidates for the Service, and said that two very important questions had to be asked in this connection: (1) was he likely to acquire the art of flying? (2) was he likely to be able to stand the wear and tear of flying? He emphasized the point that a man with good arm and leg movement and coördination might fly successfully even though he might not have perfect vision. In regard to the second point, if a man's vision could be easily deteriorated by fatigue, that was a man one had to watch. But men's eyes could be greatly improved by rest and training. He thought a military pilot should have visual tests at varying altitudes for a period of at least one hour: an ophthalmic specialist should be there to test the vision. Even then much would remain to be settled. He thanked Professor Parsons for his suggestion as to research on this subject.

(*To be concluded in the November number.*)

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY NEW YORK ACADEMY OF MEDICINE.

By ELLICE M. ALGER, M.D., SECRETARY.

MONDAY EVENING, MAY 19, 1919. DR. ARNOLD KNAPP, CHAIRMAN.

Dr. M. J. SCHOENBERG presented a patient, one of whose eyes had been previously removed for **glioma**, while a subsequent growth in the second eye had been apparently arrested by the X-ray and radium. (For full report see page 485.)

DISCUSSION: Dr. H. H. TYSON had had a similar case in which this method of treatment, however, had not been permanently successful. Dr. ARNOLD KNAPP thought that this was a very important case because retinal glioma is bilateral in about twenty per cent. of the reported cases, and permission to enucleate the second eye can very rarely be obtained. Dr. A. E. DAVIS thought the present appearance of the eye strongly suggestive of syphilis and inquired if this had been excluded, and in reply Dr. SCHOENBERG said he excluded it because there were no other indications of that disease and because the serological reaction of both parents was negative. The tuberculin reaction was also negative. It must be admitted that the choroidal changes near a glioma were unusual. The cataract was not there before the second radium treatment which lasted eight hours, and was probably the result of the treatment, as the face was burned as well.

Dr. GEORGE H. BELL presented a patient with **angioneurotic œdema,** who first came to his clinic at the New York Eye and Ear Infirmary on May 10, 1919. When first seen there were marked œdema and swelling of eyelids, upper and lower, and big bags under both lower lids. Also the lips and throat were swollen, and the patient at times had great difficulty in breathing. This swelling of eyelids was sharply defined and did not pit on pressure. The attacks passed away in twenty-four to thirty-six hours and left the patient all right until another attack. He has had the trouble seventeen years. Urine normal. Blood pressure normal. The patient attributed the attacks to changes in the weather, but Dr. Bell thought that they were due to some protein toxin.

Dr. GEORGE H. BELL presented a drawing of a **cutaneous horn** 14*mm* long of the lower lid, regretting that he could not present the patient. These horns are very rare, and this was the second one seen by him in twenty years.

Dr. C. E. McDANNALD presented a **twin child with interstitial keratitis,** first seen and reported several years ago, which had recently had a recurrent attack. The unusual feature was that the child's mother and the child itself had from the first positive blood Wassermann reactions, while the father and the other twin have been both clinically and serologically free from any sign of syphilis. Dr. McDannald offered no explanation of the unusual condition. The mother had been previously married but nothing was known of the history of the first husband.

DISCUSSION: Dr. CUTLER suggested that a provocative salvarsan might reveal disease in the healthy twin. Dr. SCHOENBERG suggested that the child might have been infected after birth and that both father and the other twin might be syphilitic in spite of the negative Wassermann reactions. He deprecated a provocative salvarsan as not devoid of danger.

Dr. H. H. TYSON presented a patient with **spontaneous pulsating exophthalmus.** Recovery without operation.

Mrs. B. N. B., aged 43 years, was referred to him on June 29, 1918, on account of proptosis of her left eye, with the history that five weeks previous she had had a severe pain behind her right eye and on the right side of her head, with surging through her head from side to side synchronous with her pulse; and also had pain in her left ear, the pain finally localizing behind her left eye. About one week previous to visit she had noticed that her left eye began to protrude with slight fullness behind her left ear. Examination: veins of upper lid were dilated, pulsation obtained, blowing bruit over both eyes, marked over left eye. Chemosis ocular conjunctivæ appearing above lower lid in palpebral fissure, left eye fixed in median line, very slight motility, marked exophthalmos left, diplopia variable in all fields. Tn. pupils dilated with sluggish reaction to light, consensually and on attempted convergence. Fundi slight congestion of retinal veins. Following report from Dr. Goldhorn, Mt. Vernon Hospital, who also prepared the photographic negatives presented, showing condition at that time: Urine 1018, negative. Wassermann negative. Spinal fluid and gold globulin negative. Sinuses negative, B. Pr. 160 to 190—X-ray showed prominent vessels on left side of brain due to intense congestion. Neurological examination by Dr. L. P. Clark negative. Vision with glasses O. D. $\frac{20}{200}$, O. S. $\frac{20}{70}$ Comp. myopic astigmatism. No history of trauma obtainable. The only possible cause determined was strain caused by rather violent effort at singing, in trying for high notes; as the pain behind left eye followed shortly after.

A diagnosis of spontaneous pulsating exophthalmos due to arteriovenous aneurysm in the cavernous sinus was made and ligation of the left common carotid was advised. She entered the Mt. Vernon Hospital with the intention of having the operation performed, but on account of the objection of some members of her family, later the operation was refused. She remained at the hospital under observation and treatment of Dr. Quinn, her family physician, and I examined her eyes on several occasions. For ten weeks the treatment consisted of rest, diet with digital compression of carotid for a time, and sodii iodid internally. On July 12th, extensive chemosis was present with portion of left ocular conjunctiva resting upon the cheek. Ophthalmoplegia totalis with paralysis of seventh cranial nerve with small retinal hemorrhage in fundus O. S. On September 10th, punctate retinal hemorrhages O. S. Pupils react to light sluggishly. Chemosis conjunctiva on temporal side and inferiorly, bruit heard all over head, loudest and lowest tone heard over left eye. Feeling much better, facial palsy improved. Cornea clear Tn. B. Pr. 168. May 14, 1919. Vision with glasses O. D. $\frac{20}{30}$, O. S. $\frac{20}{50}$. B. Pr. 180. O. S. fundus, pallor left optic nerve (partial pressure atrophy) retinal pigmentation due to former hemorrhages. Tn. slight chemosis inferiorly and near outer canthus, slight diminution of motility outward (abducens paresis) contraction of color field about one half. No bruit upon auscultation nor pulsation obtained. Feeling very well. No noises in head nor vertigo. Noises stopped about two months ago. As she has not been receiving any treatment nor medication for the past six months we have what may be considered a spontaneous curve, as although the previous treatment and medication may have had some beneficial effect there has been an interim of six months with no treatment.

Dr. A. E. Davis presented a child with **tuberculosis of the choroid.** She was first seen six years before when she showed a spot of choroiditis near the macula of the left eye. A von Pirquet at this time was negative and the child consequently placed on antisyphilitic and tonic treatment which was not effective. A few weeks later she sustained a trauma which ruptured the choroid of this eye in the macular region, and soon after was lost sight of. Six years later she reappeared with the history of severe headache and nausea with blurring of vision in the other eye, which was reduced to $\frac{20}{40}$. A grayish area could be seen below the macula and there was a paracentral scotoma above. A von Pirquet at this time resulted in slight rise of temperature and there was a reaction on the arm and in both eyes. One mg. of O. T. resulted in a marked local, focal, and general reaction, while subsequent treatment with therapeutic doses of tuberculin had caused marked improvement in vision. Dr. Davis also showed a child of five years with **double congenital ptosis** on which he had recently done the de Grandmont operation. Three millimeters of the cartilage, skin, and orbicularis were removed from the left lid and two and a half from the right and the wounds closed by interrupted sutures reaching entirely through the lids. His experience with the de Grandmont operation had been very favorable, as this case shows, and he had never seen an over-effect even when rather large sections of cartilage were removed.

Dr. Arnold Knapp presented a case of **spontaneous reduction of tension in glaucoma.** A little girl 12 years old, with a myopia of 7 D. was first seen, in the fall of 1917, vision being

R. $\frac{20}{200}$, L. $\frac{20}{100}$. The pupils are a little excentric. The depth of the anterior chamber was not uniform with a slight tremulousness of the iris, suggesting a partial subluxation of the lens. The circumcorneal part of the sclera was blue, the field being contracted to 10°. The optic nerves were cupped, with pronounced atrophy. Tension from 60–70.

She had one brother who is also myopic with a tension varying between 28–40, with normal sight and a normal eye ground.

The right eye was operated upon, followed by a retrochoroidal hemorrhage, prolapse of vitreous, subsequent phthisis, and enucleation. The left eye, with the very bad experience which was had on the right eye, was treated with drops. The tension in January, 1918, was 36 and then gradually went down until in November, 1918, it was 13, at which it has remained up to the present time. To-day vision with glasses was $\frac{20}{200}$. She had a shallow anterior chamber. The optic nerve showed no cup but is very white.

The case was of interest as showing a glaucoma which apparently was secondary to a partial subluxation of the lens, and that these eyes do not stand operation well and, further, that by leaving them alone or by means of drops the tension may be satisfactorily reduced.

Dr. P. B. HOUGH showed a child of one year who, since the second month had presented a small but gradually increasing **orbital tumor.** This is situated at the juncture of the frontal ethmoid suture and was about 6*mm* long and 3*mm* wide. At first it was of bony consistency, immovable and with no signs of inflammation. Recently the mass had increased at least a third in size and become cystic in character. The points of interest were the early hardness, the very slow growth, and the later sudden change in character and rapidity of increase.

Dr. J. WOLFF thought it was almost certainly a dermoid tumor.

Dr. E. M. BLAKE presented a child with a **cilium in the anterior chamber.** There had been a trauma with prolapse of the iris at the limbus, which had been excised and covered with conjunctiva, the cilium not being visible till the wound had healed. As there was not the slightest sign of irritation the general consensus of opinion was to leave it undisturbed.

Dr. I. GOLDSTEIN presented for Dr. J. E. Weeks the following cases.

Case 1. **Maculo-anæsthetic leprosy of brow and cornea.** Male, 30 years old, parents are perfectly well, Russian; occupation, rag picker; ill six years. Upon the eyebrow of left eye are four or five round macules, of brownish red hue, the centers of which are white and depressed, while the borders are elevated and colored. Macules are anæsthetic. Ocular conjunctiva injected on temporal side and extending somewhat on to cornea, where there is a small opacity at its center. Cornea is insensitive. The hairs of eyebrow and eyelashes are largely missing. There is an abundant growth of hair upon the scalp which is free from all manifestations of the disease. The ulnar nerve is palpable as a whip cord at the left elbow. Both hands are the seat of secondary atrophy of hyper- and hypothenar eminences. The interossei are atrophied with the result that the "Main en griffe" is developed. The lepra bacillus was recovered from the nasal secretion.

Case 2. **Argyrosis of conjunctiva and cornea.** Male, 65 years old, Russian; eighteen years ago Dr. Weeks operated for trichiasis, restoring the lid margins in both eyes. At the present time he presents in both eyes a very marked pigmentation of the ocular conjunctiva which is almost black. The cornea likewise in both eyes is stained, the color being a dark brown. About ten injections of 1% "K. I." were made into the conjunctiva without any result being obtained.

Case 3. **Cholesterin crystals in hypermature cataract.** Female; 62 years old; American; complains of poor vision in O. S. for the past few years, with oblique illumination; many glistening points are seen in the opaque lens. This is probably a degenerative process.

Dr. MARTIN COHEN presented an **apparatus for securing a red free light for fundus examination** by means of a Wrattner film filter. (This will appear later.)

Dr. J. G. DWYER then read the paper of the evening on **a further report on the treatment of focal infections of the eye from the intestinal standpoint.** (This paper appeared in the previous issue.) The method employed consisted of intestinal irrigations with various solutions, especially anhydrous sodium carbonate, with the idea of removing, so far as possible, abnormal flora, restoring the normal reaction of the intestinal contents, and at the same time making implantations of the colon bacillus. Dr. Dwyer reported many cases illustrating the beneficial effects on numerous chronic eye conditions.

Mr. J. J. CONNELLAN discussed the paper from the standpoint of the laboratory man. (His discussion appeared in the preceding issue.)

Dr. J. A. MCCREERY said he had used the treatment in a great variety of medical and surgical conditions and had had no complete failures and many marked successes. He was very enthusiastic but his experience did not include eye conditions.

Dr. LEO KESSELL also spoke from the standpoint of the internist. His experience had been very favorable but he thought at present the method was in more danger from its friends than its opponents. It was being used indiscriminately on all sorts of ill selected cases and might easily be discredited.

Dr. WM. E. DEEKS had had no experience with the method but thought many of the results could be brought about equally well by regulation of diet. He alluded to the recent experiments showing the marked control on the intestinal flora exercised by appropriate dietaries and emphasized the importance of cutting out the sugars and starches. The first had been added to the list of human foods within comparatively recent years and was everywhere being used in excess. It was responsible for much of the excessive acidity.

Dr. G. H. BELL said that this was a subject in which he was very much interested, and was sorry that he did not have the facilities for carrying on this work at the hospital. He agreed with Dr. Deeks that we must consider the cane sugars and carbohydrates as great factors in producing acid stools and in destroying the colon bacillus in the intestines. We must remember that the carbohydrates are aldehyde and ketone derivatives of complex alcohols. Dr. Bell then reported a case of toxic amblyopia in a woman, aged twenty-seven, who had been a great consumer of candy and two or three sodas a day. Her vision when first seen was $\frac{20}{200}$. Her fields showed a central scotoma extending from the blind spot to the fixation point. Dr. Bell had a chemical analysis of blood made, which showed a high blood sugar (0.18 per cent.). Her Wassermann was negative. Her urine showed high specific gravity, 1027, and a positive reaction for sugar, and high indican reaction.

The average glucose content of normal blood is 0.10 per cent. The increase in her case, Dr. Bell thought, was brought about by the excessive ingestion of candy and sweets, for the reason that after the ingestion of large amounts of cane sugar or glucose, causing the assimilation limit to be exceeded, an alimentary glycosuria would arise.

The patient was taken off of all sweets and carbohydrates and given the Bulgarian bacillus internally. At the end of three months' treatment, her vision was normal. This was a case of autotoxæmic amblyopia due to the anomalies of metabolism.

Dr. Bell held that every case of retrobulbar neuritis should have a chemical analysis of blood made. Estimations of the blood sugar are undoubtedly of great value in treating these cases of toxic amblyopia.

Dr. J. G. DWYER in conclusion said that, excluding syphilis and tuberculosis, most of the low grade, non-progressive, fluctuating lesions are due to toxins from the teeth, tonsils, or intestinal tract. Generally both eyes were involved. The treatment has been worked to death. Diet alone has not been sufficient, though every article of food should be cut out that cannot be digested.

MISCELLANEOUS NOTICE.

In the meeting of May 3, 1919, of the Norwegian Society of Science in Christiania the Fridtjof Nansen Prize—Kr. 2000—was awarded to Hj. Schiötz and S. Holth for prominent work on glaucoma.

The *Transactions* of the *American Ophthalmological Society* can be obtained in single bound volumes by applying to Dr. T. B. Holloway, 1819 Chestnut St., Phila. Price $4.00.

ARCHIVES OF OPHTHALMOLOGY.

NON-OPERABLE TUMOR OF THE ORBIT AND BROW, TREATED SUCCESSFULLY WITH RADIUM. REPORT OF A CASE WITH A FEW REMARKS.[1]

BY GEORGE HUSTON BELL, M.D., AND SINCLAIR TOUSEY, M.D.,
(BY INVITATION), NEW YORK.

(*With six illustrations on Text-Plate XVIII.*)

SKEPTICISM in regard to the value of radium in the treatment of malignant and non-malignant tumors is fast disappearing. It is now generally recognized by surgeons of the largest clinics that radium is a great therapeutic agent and a valuable adjunct in the treatment of cancerous and precancerous growths. For these reasons we decided to try radium with this patient.

A woman, aged 65 years, came to Dr. Bell's clinic at the New York Eye and Ear Infirmary on December 13, 1917, with the following history: nine months before she ran into a door jamb and struck her forehead a severe blow on the left side.

The first thing she noticed was a lump on her forehead, which at times gave her some pain. She went to Bellevue Hospital, where she was treated in the Out-Patient Department for six months, with anti-syphilitic treatment, although her Wassermann at that time was negative.

After the swelling on the forehead became more noticeable, she observed that her left eye began to get more prominent than the other one, and the upper lid began to swell. The tumor got larger and larger, the eye more prominent, and the pain increased. Finally she was sent to the New York Eye and Ear Infirmary for treatment.

Status Præsens. Her whole head and face was enveloped in a black veil; on removing it, she presented a ghastly spectacle. Under the bandage which was soaked with blood was an enormous tumor of the orbit and brow. The cornea had ulcerated and perforated, and the eye was bleeding freely. The globe was markedly proptosed. The tumor had pushed out of the orbit, the eyeball, which was displaced downward and inward. There was a solid tumor filling the orbit, which extended well over onto the frontal bone. The upper lid was greatly swollen, and the tension was so great that it could not be elevated. The eyebrow and the skin of the forehead were greatly stretched. The cornea could be seen projecting between the eyelids. See photograph No. 1. This was taken on her first visit to the hospital and will give you some idea of the growth.

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[1] Read at meeting of American Ophthalmological Society, Atlantic City, June, 1919.

The patient was ordered into the hospital at once. She was so weak that we did not try to get a section of the growth for the laboratory.

An X-ray of the skull, including the teeth, was ordered, also a Wassermann.

Previous history: Married and four children, all of whom are living. Had not been sick in twenty years. Had never had a miscarriage. The last sickness that she remembers having was typhoid fever.

Dr. Dixon's report of X-ray findings of skull: Frontals about proper size; right fairly clear; left rather hazy, due to overlying tumor. Left orbit seemed filled with the growth, and there was a soft-looking area in the frontal bone above the left orbit. Antra were fairly clear. Sphenoids were large and did not seem to be involved.

X-ray of teeth: considerable amount of alveolar absorption with what appears to be a cavity around the almost completely absorbed roots of the upper bicuspids, and some absorption at the roots of the molars.

On inspection of the mouth we could see that her gums were not pink, firm, and healthy-looking, but were purplish and swollen and there was a red line adjacent to the teeth. We decided that she had a dirty mouth and we had all her teeth (12) extracted. The report on her Wassermann was negative. This was the second negative report.

The patient was shown by Dr. Bell at a meeting of the New York Ophthalmological Society, and also at the Section of Ophthalmology at the New York Academy of Medicine. All the oculists who saw her advised against an operation. It was then that we decided to use radium, and Dr. Tousey very kindly offered to treat the patient, and to use his radium salt. The first treatment, which lasted one hour, was given on December 19, 1917.

Applications were made of 20 milligrammes of radium salt of two million activity. This was enclosed in a sealed glass tube, that again in an aluminum treatment tube, that in a lead wrapping about $\frac{1}{50}$ inch thick, and that finally in the soft rubber cover from Oberlander's urethrometer. The radium was left in one place for an hour at each treatment. The places were 1½ inches apart and at first the tumor was so large that there were six of these areas to be treated, one each week. Two weeks from the first treatment decided shriveling of the skin was to be noted, and the patient was sure the tumor was smaller. The surface was of less and less extent so that toward the end only two places received the application, one above and one below the supraorbital margin. At no time was there any cutaneous reaction but on the contrary a steady change from the original glistening appearance to that of healthy skin. The first treatment was on December 19th, and the last on April 1st.

The treatments were continued every week by Dr. Tousey, and on March 13th, the second photograph was taken. The improvement was so great, and the reduction in the size of the tumor was so progressive, that we were encouraged to go forward with the treatment. Fig. 2 shows that the teeth had all been pulled.

On April 1st, Dr. Tousey pronounced her cured. There was a shrunken globe remaining, which was enucleated under local anæsthesia.

The last photograph (Fig. 3) was taken May 4, 1918, after the glass eye had been inserted.

Dr. Bell saw the patient again on January 1, 1919. She had had no recurrence of the growth and had gained twenty pounds in weight. This patient had no internal treatment.

The cosmetic result is now about perfect (Fig. 3). The clinical diagnosis of sarcoma was made by us. We are sorry that we have no laboratory report to offer; the patient was so weak and feeble when first seen by us, that we did not feel like torturing her any more. However, we feel confident about the diagnosis.

Zinzi (1), of London, reports a case of orbital sarcoma successfully treated by radium, which had recurred twice, once after enucleation and again after a growth in the orbit had been removed. One hundred and fifty milligrams of radium bromide were used at first, and then two hundred milligrams. Zinzi was so well pleased with this result that he showed the patient on May 5, 1916, before the Ophthalmological Society of the United Kingdom.

Aikins (2), in reviewing radium as a therapeutic agent, speaks of its great value in rodent ulcers, vernal catarrh, and exophthalmic goiter.

Some of the most careful work has been done by Axenfeld (3). He reported, in 1915, results obtained after treatment by radium, of a case of glioma in a child whose right eye had been removed for glioma. At the time of enucleation of the gliomatous eye, three foci of growth, one rather large, were seen in the left eye. Radium treatment was instituted. He made eleven careful fundus examinations, noting the decrease of the growth, and in eighteen months after the first treatment, reported that one area had disappeared, another was almost gone, and the third, the largest one had very much decreased in size. In 1916 he reported further progress in this case. The largest growth had completely disappeared, leaving only an evidently dead preretinal trace, with no recurrences elsewhere. Axenfeld was able to demonstrate to his own satisfaction the good effects of radium in the treatment of the glioma case.

In conclusion Axenfeld holds that blind gliomatous eyes should be excised, but that for commencing glioma in the still seeing eye, radium is not only justifiable, but obligatory.

C. F. Clark (4) treated sarcoma of orbit by inserting a tube of radium in the orbit after canthotomy and division of external rectus. The radium was left in four hours, and this was repeated every two weeks. The proptosis quickly receded, and in two years the case was apparently cured. It is interesting to note that a nuclear cataract developed after six months of the treatment, perhaps due to the radium.

Recently S. Gifford (5) reports a case of leucosarcoma of the iris, treated by radium. He concludes by saying that in tumors of the iris, treatment by radium should be seriously considered where the growth is not especially rapid. Even if it has reached the iris root, such treatment should be offered to the patient as an alternative to operation, he being observed carefully during each treatment. Where operation is refused, it would seem only just to the patient, to very urgently advise radium.

Henckel (6) reported a case of melanosarcoma of the orbit, treated with radium, which was held in abeyance for two and a half years.

Arch. of Ophthal., Vol. XLVIII., No. 6. **Text-Plate XVIII.**

ILLUSTRATING DR. BELL'S AND DR. TOUSEY'S ARTICLE ON "NON-OPERABLE TUMOR OF THE ORBIT AND BROW, TREATED SUCCESSFULLY WITH RADIUM."

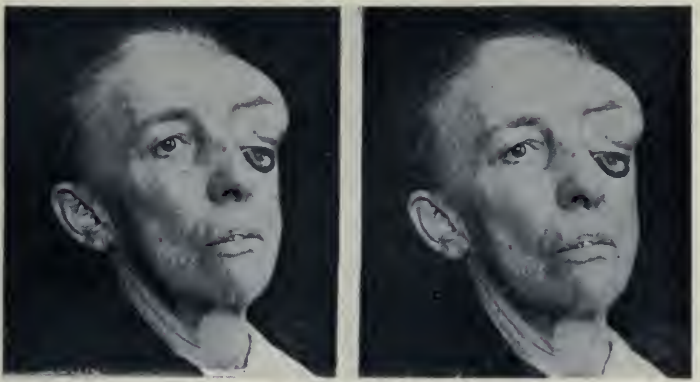

FIG. 1.
Taken December 14, 1917.

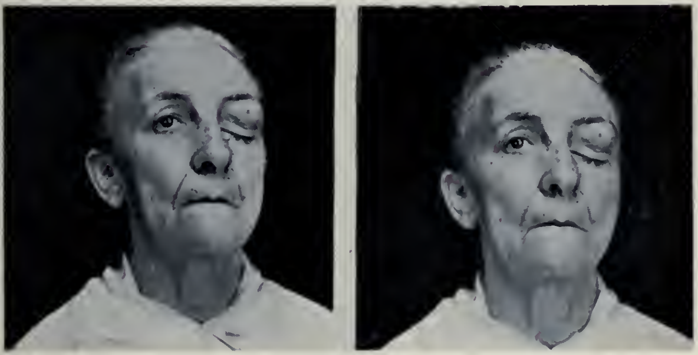

FIG. 2.
Taken March 13, 1918.
Note the marked reduction in size of tumor, also expression of face since extraction of all the teeth.

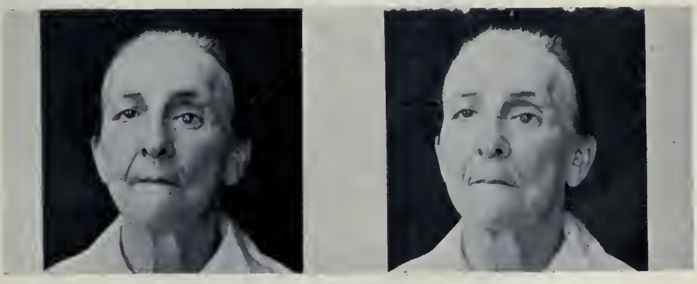

FIG. 3.
Taken May 4, 1918, six months after treatment was instituted.
Cosmic result now about perfect.

We have treated five cases of vernal catarrh with radium, the plaques have completely disappeared, leaving no scars at all, and so far there has been no recurrence, after two and three years.

CONCLUSIONS.

We cannot lay too much stress upon the use of radium in all tumors of the eyelids, orbit, and brow, when syphilis can be excluded, and we hold that it should be given a thorough trial by competent observers, before resorting to surgery.

We also feel that radium should be used in tumors of the iris, when syphilis and tuberculosis can be excluded, before resorting to surgery. Most especially do we recommend the use of radium in these iris tumors where they are growing slowly, and where we can keep a close observation of the patient. In the treatment of all intraocular tumors, radium should be seriously considered.

We are of the opinion that radium is the most effective agent we have in the treatment of epithelioma of the eyelids, as it is easily controlled as to dosage and effect.

We look upon radium as a specific in spring catarrh.

We hold and claim that radium has great value as a therapeutic agent, but before instituting treatment in any given case we claim that all the sources of focal infections must be cleared up and eliminated. The established value of radium we think is now pretty well recognized, although it is not used by ophthalmic surgeons as often as one would suppose.

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SOME CASES OF LETHARGIC ENCEPHALITIS.[1]

By HIRAM WOODS, M.D., Baltimore, Md.

SINCE the early part of 1918, a peculiar disease termed "lethargic encephalitis" has been appearing sporadically throughout Europe, and more recently in America. Because of the frequency with which paralysis of the eye muscles occurs, the disease was at first termed "lethargic ophthalmoplegia." The muscular abnormalities are peculiar: the usual causes of paralysis (syphilis, diabetes, and tabes) are absent. Without actual paralysis, there is often a nystagmoid action of the ocular muscles. There is a tendency to spontaneous recovery.

Insomuch as the ocular manifestations do not seem to have been heretofore made the object of special study, it has seemed worth while to report somewhat minutely several cases which I had the privilege of observing during the months of February, March, April, and May. In the seven cases, the diagnosis of lethargic encephalitis seemed justified, although in one case (7) it seemed, in the end, erroneous.

HISTORICAL.

The disease appeared first during the winter of 1916–17 in Vienna and was termed "encephalitis lethargica" by von Ecnomo (1). In March, 1918, Netter (2) at the Société Médicale des Hôpitaux at Paris drew attention to several cases of lethargic encephalitis which were occurring sporadically throughout Paris. In the April following, in England, seven cases were reported by Harris (3), and ten by Hall (4) who at this time were inclined to believe the disease due to an infection by bacillus Botulinus from ingestion of contaminated food. This assumption was, however, immediately questioned by McCaw, Perdrau, and Stebbing (5) and still later by Melland (6). Meanwhile many additional cases were reported. On May 5th, at the Academy of Medicine of Paris, Netter (7) again reported upon cases which were appearing in increasing numbers. At this time Netter drew attention to the similarity of this outbreak with the epidemic of Nona, which in the spring of 1890 followed the pandemic of influenza. Throughout 1918 cases continued to occur in France and England, causing such concern in England that it was made the subject of an extended investigation by the Local Government Board, through their Medical Research Committee.

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[1] Read at meeting of the American Ophthalmological Society, Atlantic City, June, 1919.

In this country the disease seems to have appeared early in 1919. On February 21st, at the Institute of Medicine of Chicago, during the discussion on influenza, Dr. Peter Bassoe (8) reported having seen several cases in Chicago. Lethargic encephalitis was the subject of editorial comment in the *Journal of the American Medical Association* in February, 1919, and again in March, while cases were reported by Ely (9) in April and by Tucker (10) in May.

The symptoms of the disease as described by the above authors consist in a rather insidious onset, the patient becoming languid and drowsy with or without headache and vomiting. This drowsiness gradually deepens into a profound stupor. This stupor may last for days or weeks. Almost as common as the sleep are the muscular and nervous phenomena. These usually point to an involvement of the bulbo-pontine area and consist of ophthalmoplegias of various extent, usually extrinsic (ptosis, recti muscles), more rarely intrinsic. Common paralyses, also, are those of the facial nerves, of speech and deglutition. More exceptionally general muscular tremors are observed and but rarely is there paralysis of the limbs. Melland (6) states the case as follows: "Special symptoms produced by the disease depend, of course, upon the particular region of the gray matter of the brain involved. For example, polioencephalitis superior, which affects the nuclei of the cerebrum and cerebellum, may give rise to marked mental changes, coma, hemiplegia, diplegia, and ataxia; while polioencephalitis inferior, which affects the nuclei of the pons and medulla, may cause paralysis of one or other or several of the cranial nerves, and combination of the two may be met with."

Fever is usually present but not always and is not of long duration. When present it simulates the temperature chart of typhoid fever. Kernig's sign is rarely present. The examination of the cerebrospinal fluid shows only slightly abnormal findings. The tension is usually normal or only slightly raised. Globulin and glucose are usually not present. The cell count in not generally greatly elevated, and when increased, the increase is in lymphocytes. Indeed, Netter considers the relatively normal appearance of the spinal fluid to be of great aid in the diagnosis.

The course of the disease is variable, running from several days to several weeks or even months, and terminates usually in complete cure or in death without farther bulbar phenomena. In favorable cases the change for the better usually comes sharply; but psychic and somatic changes may persist for some time—difficulty in accommodation being one of the most persistent symptoms. The mortality appears to be about 50% (Netter). Others put it at a lower figure.

The pathology of the disease is obscure. The macroscopic findings reported by various authors are slight, and consist generally in meningeal congestion, petechial hemorrhages throughout the gray and white matter, and in one case œdema and congestion in the floor of the fourth ventricle.

Microscopic examination shows brain lesions somewhat similar to those occurring in the cord in poliomyelitis. These lesions consist of a perivascular cellular infiltration, especially in the bulbo-pontine region and around the nuclei. In the cases showing the symptoms of polioencephalitis superior, the lesions are correspondingly higher up in the cerebrum.

As to etiology, in England it was first thought to be a cerebral toxæmia due to bacillus botulinus, but more prolonged observations and bacteriologic examinations (11) showed this to be erroneous. Likewise, pathologic, bacteriologic, and animal experimentation showed the disease to be distinct from anterior poliomyelitis. Netter reports that von Weisner (11) claims to have reproduced the disease in monkeys by the intradural inoculation of brain emulsion from a patient dead of the disease, but was unable to reproduce the disease if the brain emulsion was passed through a porcelain filter, showing it was not due to a filterable virus. von Weisner further claimed to have isolated a Gram-positive coccus from the brains of subjects and monkeys who have succumbed to the disease. These findings were not, however, substantiated by bacteriologic researches and animal experimentation of the English investigators, their researches giving negative results (12).

Several observers, notably Bassoe and Tucker, in this country have emphasized the occurrence of this disease following influenza and regard it as a cerebral manifestation of the disease. The English investigators, however, suggest that lethargic encephalitis is an autonomous infection and until conclusive proof can be brought forward proving to the contrary, the disease must be regarded as a "malady sui generis," of which the specific causative agent has not yet been discovered.

CASES SEEN BY THE WRITER.

CASE I.—*Synopsis.* Referred by Dr. Wm. G. Coppage of Baltimore. Exposure to influenza and diphtheria. Lethargy ten days, diplopia due to paralysis of inferior recti; also anisocoria, cycloplegia, partial ptosis, variation in degree of paralysis, nystagmoid movements, optic neuritis. Condition about four months after onset: defective action in inferior recti and accommodation, normal central vision, field contraction (a late development).

M. N., age 13 years, came to my office, February 18, 1919. He gave this history: well, up to ten days ago; in January was exposed to influenza, but did not have it; two children in the family had diphtheria; patient had had no symptoms of disease, and there had been several cultures taken from his throat, all negative. On February 9th, he visited Camp Meade and on returning home had diplopia and eye pains. Drowsy for ten days before I saw him.

I found him sound asleep in the waiting room; he roused easily, walked into the office and sank instantly into a stupor. Temperature 98°, pulse 42. He was mentally clear when awake. Could open eyes widely but lids drooped and presented appearance of moderate double ptosis. Left pupil larger, doubtful light reaction left, very slight, right. No convergence contraction.

Extrinsic Muscles. Lateral movements normal both ways, with slight rotary nystagmus at extreme end, each direction. Made no effort at convergence until the test object was within 8 or 10*cm* from eyes. Then he used left lateral motion, fixing with right, the left eye suddenly diverging. Up motions normal; down, entirely lost, both eyes. Orientation defective in all fields except above. Accommodation lost but he read at 33*cm* with + 3.5 d., either eye. Vision right $\frac{20}{30}$, left $\frac{20}{20}$ (–).

Ophthalmoscope showed blurred neuroretinal margins and engorged veins, judged by comparison with size of arteries. Fields were impossible, until the 11th of March (three weeks later) when they were normal. At his first visit, I was inclined to the diagnosis of brain tumor on account of the low neuritis, slow pulse, and stupor; but the character of paralysis, absence of nausea, and history of exposure to infection made this diagnosis very uncertain.

The boy was seen at his home the next day, February 19th, with Dr. M. H. Thomas. In addition to the above, we noted weakness of both facials, Kernig's sign, slight stiffness of neck and tenderness over masseters; patella reflex was exaggerated, other deep reflexes normal. Boy could be made to walk, but gait was unsteady and he would sink into a chair or on a bed and fall into stupor if left alone.

He was sent to the Union Protestant Infirmary for study. Condition continued as stated for three days, when lethargy lightened. He was in hospital to 5th of March (12 days). During that time he presented a variation of symptoms. At times the pupils responded to light almost normally. Then, after a few hours, they would dilate ad maximum and become immobile. No accommodation. The pupils stayed unequal, the left always larger than right. Twice the left pupil changed its shape from regular, full dilation to an oval, with long diameter horizontal. There was similar variation in the deep reflexes. One day all were lost except the left knee. Then they returned. Abdominal reflexes were absent for several days. Dermatographia was constantly present. He voided urine involuntarily. At times the body muscles twitched spasmodically. Kernig's sign persisted. It was always more painful on the left side. The weakness of the facials, noticed on the 19th of February, developed into an almost complete double paralysis and then cleared. Temperature varied from 99 to 101 for three days, then became normal.

Laboratory findings were: urine normal, blood and spinal fluid Wassermann, negative to all tests, the fluid coming under normal pressure, drop by drop and clear. Cell count, 39 to cubic *mm* slightly positive globulin, no organisms. Leucocytosis 7000. After a week in the hospital with these varying symptoms the lethargy passed off and the boy lay in bed awake, rational. He left the hospital with all symptoms improved except the low grade of optic neuritis, complete paralysis of accommodation, and inferior recti and slight left facial; also unequal pupils, with slight light, and no convergent response.

March 11th (six days later) I found the following: vision, right $\frac{20}{50}$, left $\frac{20}{40}$. The papillitis had about disappeared. Left pupil the larger of two. Good light, slight convergence, reaction: no accommodation. Changing position of eyes from above to the horizontal plane, or lateral movements produced rotatory nystagmus. Eleven days later he showed a little motion down, 15° to 20° on perimeter. Vision was $\frac{20}{40}$ right, and $\frac{20}{30}$ left. Pupillary reaction was good for light and convergence which had completely recovered. Accommodation had improved about one diopter. From this time, there was improvement with, however, occasional variations. These affected vision and mobility. Vision varied from $\frac{20}{30}$ each on March 22d to $\frac{20}{50}$ on the 27th. On the latter day all the gain in accommodation had been lost. On April 17th (two months after onset) vision reached $\frac{20}{15}$. There was no accommodation, + 3.5 sph. being again needed for reading at 33*cm*. This held ten days later. The left pupil remained the larger, but each showed normal reaction. His down movement had increased on April 26th. At the termination of both up and down movements, there was a tremor of the eyes before they became quiet. This was not the case with lateral movements. Accommodation was still nil. Vision was $\frac{20}{15}$ each.

May 26th (five and a half weeks later), his condition was: right vision $\frac{20}{15}$. Read newspaper print for a moment at 40*cm* with the right eye, but could not hold it. Accommodation about two diopters. Vision, left $\frac{20}{15}$. Accommodation one diopter. All movements normal except downwards. Slight nystagmoid movements at end of excursions, up, down, or lateral. Fields show contraction, in comparison with those of six weeks ago. General demeanor heavy and he tires quickly on keeping eyes fixed. Fields, unreliable.

Case 2.—*Synopsis.* Previous influenza, lethargy followed by "jerking of eyes and difficulty in locating objects till the eyes get still" (patient's description). Nystagmoid movements; facial paralysis.

Mr. N. W., 29 years of age, farmer, saw me first on March 4, 1919. He had a myopia of 1.25 diopters with normal vision. History of influenza the first week in January: recovered. On February 20th, at the automobile show, he fell asleep. His wife woke him, he walked around a few minutes and went to sleep again. Went home and slept three days and nights. Felt well, but could not keep awake. On February 24th was giddy. Still occasionally so. First eye symptoms on the 25th. He said: "Lids and eyes twitched if I looked at anything; end of last week, eyes did not keep still long enough to pick out print to read."

Examination showed normal fundus and media; vision with glasses right $\frac{20}{40}$, left $\frac{20}{20}$. The right obtained $\frac{20}{20}$ when "it got quiet." Punctum proximum accommodation, five diopters each. Pupillary reflexes and convergence normal. Fixation at any point, distant or near, was followed by a rotatory and sometimes vertical nystagmus which lasted about three seconds. Then eyes became quiet. As soon as the position of the eyes was changed and a new point of fixation sought, oscillations were renewed. When the eyes were closed there were tremor of both upper lids and occasional orbicularis twitching. This was also noted in lateral movements either to the right or left. This condition was observed for three days.

Two days later (March 9th), he developed a most curious muscular action. Convergence and lateral movements were normal, save for the oscillations which passed off in a few seconds. The same was true when he looked downward; but on looking up, following a finger or test object, the eyes moved slowly up, a certain distance, and then, as though working on a spring, they both converged violently. This spasmodic convergence was accompanied by farther jerkings inward. He was totally unable to abduct the eyes when directed above the horizontal plane, but when he was told to look down, the axes became parallel.

On March 11th, he developed right facial paralysis. He said the drawing of the face to the right was a "queer trick," he had. On the 12th, I asked Dr. Thomas to see him with me. All reflexes were normal. Sometimes the hands trembled, also neck muscles. On getting up from a chair the thigh muscles went into a quick irregular tremor lasting a few seconds. After that he walked normally. It was impossible to get the patient to the hospital for laboratory study. After nearly three months his condition is as follows: May 10th, oscillations of eyes slight, but definite. On May 23d my case notes read: "(1) In up motions, left eye lags a little behind the right, but, on urging, the left eye is pulled up as far as right. (2) In fixation on horizontal plane, a tiny rim of left sclera above the cornea is visible; none in right eye. (3) In motions up, slight rotatory nystagmus, sometimes two or three jerks, then eyes are kept still. Face is a little drawn to the left (opposite of condition observed, 11th March.) Pupils, accommodation, convergence, fundus, and media normal." He can read and says he knows he is better because his horse "does not seem to fly about when he is getting into saddle."

CASE 3.—*Synopsis.* Exposure to influenza, had "cold." Headache (only case with this), lethargy, occasional nystagmoid movements.

E. S., boy 14 years of age, consulted me February 18th, for headache and drowsiness. The pain had come first about two weeks previous, slept all the time since. He had been exposed to influenza, but did not think he had had more than a "heavy cold" in December. Still weak.

I found drooping of both upper lids. His vision was $\frac{20}{20}$ and accommodation seven diopters, each eye.

Manifest refraction error, right +1.sph. = −0.37 cyl. ax. 180°
left +1.5 sph. = −0.37 cyl. ax. 180°

Fundus and media normal. The only defect found in motions was in lateral fixation. For instance, in indirect ophthalmoscopic examination—the eyes would suddenly roll up and the upper lids droop. The boy said the eyes did not hurt and he did not know why he could not keep them open. He was so drowsy I could hardly keep him awake long enough to examine the eyes. Lateral fixation either way produced nystagmoid movements.

Under date of March 7th, his physician, Dr. W. H. Marsh of Solomons, Md., wrote: "There has been a great improvement in E. S. since his return home. He is now at work, the drowsiness has about disappeared, and there is more of a snap about his movements."

There was no opportunity to study this case thoroughly, yet the drowsiness, drooping of the lids, involuntary motions, and slow recovery were characteristic of the other cases more fully reported.

CASE 4.—*Synopsis.* Ocular, first symptoms to appear. Sudden diplopia and left internal squint. Saw a physician who used atropia. Followed by two weeks of lethargy, with very slow return of pupillary reaction. Accommodation still defective after nearly three months.

Miss X., 19 years of age, telephone operator, was sent me by Dr. C. H. Kriete of Aberdeen on March 14, 1919. She had had no recent illness. There was a left internal squint of 45°. When the left eye was excluded, the strabismus shifted to right and the excluded eye trembled. She stated that two days before, while at work as a night operator, she had suddenly seen double. A local physician, not her regular attendant, had used atropia. This was the day before she came to me. Her refraction under atropia was: vision right, $\frac{20}{200}$, $\frac{20}{20}$ by + 2. sph., left $\frac{20}{200}$, $\frac{20}{20}$ by + 1.5 sph. The atropia had had no effect on the squint. There was definite defect in left lateral motion; the left eye would not abduct to the canthus, while the right eye would. Slight left ptosis. In view of the suddenness of the symptoms and the defective action of the left external rectus, I decided to refrain from treatment until the effects of the atropia had worn off, advising absolute rest in the meantime.

I saw her again in a week, March 21st. It was then that I first suspected lethargic encephalitis. The girl had been asleep the entire week. She would arouse and take her meals and immediately fall into a stupor. The pupils were still widely dilated and showed a barely noticeable, if any, response to light; none to convergence. She still accepted her atropia correction and the squint had disappeared. She apparently had regained about two diopters of accommodation. There was definite drooping of the left upper lid, all eye motions were good. She was lethargic during examination. She went home and slept continuously for four days. I saw her on March 25th (ten days after the use of atropia). The right pupil was the larger. Both responded to daylight and convergence. Her manifest error was a 0.5 diopter less than the total correction in the right and 0.25 in the left. She now needed +2. sph. added to her manifest error to read at 33*cm*. Correction of her manifest error was ordered for constant use.

On April 4th (just three weeks and one day after the use of atropia) the pupils were still dilated and of equal size, but reacted promptly to light. She had normal distant vision and needed one diopter added for reading at 33*cm* in the right eye (gain of one diopter of accommodation). Left eye had barely a near point of 33*cm*. (This represents for her age, according to Duane's table, a loss of accommodation of 6 to 8 diopters.) With the red glass before one eye, she developed at 20 feet a vertical homonymous diplopia correctable by 2½° prism base down before right eye.

On April 15th, she tried to resume her work. Headache and blurred vision compelled her to stop in a half-hour.

On April 21st (5½ weeks after the use of atropia) she was still about six diopters short of the accommodation normal for her age. The left pupil was larger than the right; a change since April 6th. Both reacted normally. The red glass gave homonymous, but not vertical, diplopia.

On May 12th (9 weeks and 2 days after the use of atropia) there was still inequality of the pupils but good reaction. She now had about 2½ to 3 diopters of accommodation in each eye through the glasses correcting her manifest error.

On May 25th, she had a near point of 25*cm* in the right and 20*cm* in the left eye (equal to 4 and 5 diopters of accommodation—still not over one half of the accommodation normal for her age). There was no diplopia and she was working more comfortably. She has orthophoria, distant vision. In view of the transient squint, left ptosis, lethargy, and the slow return of accommodation, I felt that the diagnosis of lethargic encephalitis was justifiable.

CASE 5.—*Synopsis.* A "cold" in January, followed by fever, lassitude, and stupor for nearly a month. At the end of that time, left, followed by right, facial paralysis, paralysis of left accommodation, periods of improvement and relapse, final recovery.

A. A., boy, 19 years old, was referred to me on April 10th by Dr. Wm. H. Pearce. So far as personal observations are concerned, there is very little for me to report. The interesting feature of the case is the early history which has been kindly furnished me by Dr. Thomas to whom Dr. Pearce sent the patient. This will be given after my own findings. He had normal central vision, no limitation of fields, a near point of 15*cm* for the right and 38*cm* for the left eye. If he looked down he developed lateral nystagmus; continuing to hold this position, the eyes became still. On looking up, there were no nystagmoid movements. They developed at once, however, on lateral motion. Pupils were of equal size and reacted normally to light and accommodation. He could shut his eyes tightly and there was no involvement of the lid.

Six days later, the boy reported that he had been very drowsy since his last visit. There were distinct tremor of the upper lids when he closed his eyes and the same nystagmoid movements on looking up, lateral motion, or convergence. The most marked change, however, was in the accommodation. The punctum proximum of the left eye had come in from 38 to 20*cm*.

The early history furnished me by Dr. Thomas shows that the boy was a student at boarding-school in Virginia, and in January, after climatic exposure, had what was supposed to be a cold. This was accompanied by dizziness and diplopia. He seems to have been more or less miserable for the next three or four weeks at school, suffering from giddiness, drowsiness, etc. Early in February (a month after the onset) he developed a left facial paralysis. He returned to Baltimore and shortly afterward the right facial nerve was involved. Dr. Thomas saw him on February 4th. He noted the expressionless face, wide open eyes, widely dilated pupils with very slight reaction to both light and accommodation; pain and nystagmoid movements on lateral motions, masseters painful on pressure, almost complete double facial paralysis. At a later visit, Dr. Thomas noticed paralysis of the left accommodation, nystagmus on any lateral motion. There was gradual improvement in all of these symptoms; but all through February and March, the boy had periods of stupor and was unable to use his eyes. At times he read better than others; simply could not see the print. At the end of March he came to Dr. Pearce with complaint of pain in the region of the heart apex. Dr. Pearce found a pleuro-pericardial friction rub, which disappeared when the boy turned on right side. Pain, moderate temperature (101°) rapid pulse persisted for forty-eight hours and disappeared as mysteriously as they had come. Anorexia and prostration followed for a fortnight. I saw this boy again on May 29th. He thinks he is well and he is with the exception of lateral nystagmoid movements when he looks upward and tries to hold the eyes in this position.

I have hesitated to include the following cases.

CASE 6.—*Synopsis.* Eye symptoms first to appear. On account of age, possibility of undiscovered degenerative changes. Left abducens paralysis and dilated and feebly acting pupils only eye symptom, most of others pointed to involvement of spinal ganglia. Stupor for over two months.

Mrs. M. E., 65 years of age, was seen in consultation with Dr. J. A. Zepp on March 22d. She had been under his care for three weeks. Some weeks prior to seeing Dr. Zepp, she had been greatly frightened and since then had been nervous and sleepless. Dr. Zepp found her with double vision and vertigo. Symptoms unchanged for a week when Dr. T. B. Futcher was called in consultation. Dr. Futcher was inclined to a diagnosis of cerebral arteriosclerosis, but nothing was positive except that the diplopia was due to a weakness of the left externus.

On March 22d, the woman was in a deep stupor. This had come on three days previously. She could be aroused and a fair examination of the eyes was possible. There was partial paralysis of the left externus with jerkings and rotation at the excursion end. It was very difficult to keep her awake. Pupils were dilated and responded to light. Ophthalmoscopic appearances were negative. Other symptoms were: loss of right patella reflex and positive Kernig. Pulse 112, temperature 98°; blood pressure $\frac{165}{95}$. I felt that positive diagnosis was impossible, but it looked like lethargic encephalitis. This diagnosis was definitely made by Dr. Futcher six days later.

At that time Dr. Zepp phoned that the woman was in profound stupor and had developed right facial paralysis.

There was tenderness over the masseters. The right patella reflex had returned and the left disappeared. Kernig's sign persisted. I saw her again on March 31st. There was complete right facial paralysis, both pupils were dilated but reached slightly to light. She could move her left hand and leg very little; right normally. She had developed a tenderness on pressure along the course of the left femoral vein. Temperature 101°, pulse 110; profound stupor. A few days later she lost control of bladder and bowels. At present this still persists, more than two months after the onset of symptoms. The lethargy is beginning to lessen, but is still present. Reflexes have returned and all symptoms are clearing except the bladder and intestinal.

The diagnosis of lethargic encephalitis seems justified by the suddenness of left abducens, followed by the facial paralysis, both of which recovered; stupor and then the symptoms referable to involvement of the spinal cord.

CASE 7.—*Synopsis*. Diagnosis doubtful. Right facial neuralgia, right ptosis, total paralysis of right internus, partial of right inferior rectus; paralysis left externus. No lethargy. Death from respiratory paralysis. Possible metastasis from a previously unsuspected sarcoma of unknown situation.

Mr. A. S., merchant, 27 years old, was sent me on April 14th by Dr. Harry Goldburg. For several days Mr. S. had been suffering from severe right facial neuralgia. Dr. Goldburg wanted the eyes excluded, as cause.

Pupillary reaction, media, fundus, etc., were normal. Each eye had $\frac{20}{20}$ vision; $\frac{20}{15}$ by + 0.75 sph. correcting his manifest hypermetropia. Punctum proximum accommodation, *22cm* each, muscular balance—left hyp.—Ex. 3½ − 1° at 20 feet and only Ex. 2° at the near point. His manifest correction was ordered and Dr. Goldburg informed that I thought the eyes were at most merely a contributory cause, if that.

One week later Dr. Futcher told me over the phone that on the 18th he had seen Mr. S. in consultation. He had found a complete right ptosis and weakness of the right internal rectus. He suspected lethargic encephalitis. I saw Mr. S. that afternoon with Dr. Goldburg and found the following: he could not sleep and was very restless and anxious though rational and free from pain. There were complete right ptosis and paralysis of the right internal rectus. The right eye lagged behind the left in down motion. The pupils were small but responded to light and accommodation. Accommodation was unaffected. In left lateral motion, the left external rectus abducted the eye about half way, when the movement terminated with a few jerks and the eye rotated down and a little out. There was a right external squint of about 20°. Dr. Goldburg was sure that the motions of the left eye were normal that morning. The man had also developed that day trouble in swallowing and vomiting. Pulse was 80, temperature, 98°. In a word, he had developed during the week since he was at my office with right facial neuralgia, paralysis of the right levator palpebræ superioris of right internal rectus, partial paralysis of the right inferior rectus without involvement of the pupils or accommodation. Between 8 A.M. and 4 P.M. of the day I saw him at his home, there had appeared partial paralysis of the left externus, vomiting, and dysphagia. That was all we found, and we all thought it a case of lethargic encephalitis. We were puzzled because of the absence of lethargy.

Three days later Dr. Goldburg phoned me that there were periodic attacks of dyspnœa. We made blood and spinal fluid Wassermann tests, and both were negative. The spinal fluid came out drop by drop without evidence of pressure. The cell count was six with slight positive globulin reaction. On Sunday, May 4th, Dr. Louis Hamburger, who was then associated with Dr. Goldburg in the case, phoned me that the man had been taken to the Union Protestant Infirmary, that he was growing rapidly worse, and, early that morning, had developed defective vision in the left eye. He also told me that a day or two before, there had been found a few palpable, small nodules in the skin of the occiput and abdomen. He had excised one from the scalp for examination. He had discovered them through the patient's complaint of pain in back of head when there was any pressure on the occiput. I saw Mr. S. about 1 P.M. He was rational, more or less in a stupor, with respiration of 40, pulse 140. Examination of the eyes was difficult and not pushed; however, I found that the muscular lesions described above persisted. When the right upper lid was raised, he saw distinctly and read, while the left was blurred. There was no apparent explanation. The man died that night of respiratory paralysis. Autopsy was not allowed.

The final point of interest in the case is the result of the study of the excised nodule. Dr. William G. MacCallum, Pathologist at the Johns Hopkins Hospital, found it a leucosarcoma. Location of the main growth is impossible; but if the symptoms were due to metastasis, they followed very accurately the course of lethargic encephalitis. The case is retained in this paper to demonstrate the uncertainty of diagnosis. The man had all the classical symptoms of lethargic encephalitis except the lethargy, and numerous cases without this, but with other symptoms, have been recorded. He had been examined by two most careful diagnosticians, and if the skin nodules were present at their examinations, they were simply missed. I believe they were of later development, certainly the abdominal.

COMMENT.

Of the seven cases here reported, two gave history of antecedent influenza, one, a doubtful history, and four, no history of this disease. In view of the negative character of bacteriologic and animal experimentation, and of the undoubted frequency in which influenza has occurred previous to the onset of the lethargic encephalitis, the most reasonable view appears to be that influenza may reduce the resistance of the individual in such a way as to make subsequent infection of lethargic encephalitis more probable.

In only one of the cases herein reported was there optic neuritis, and this was of low grade. This finding is in accord with those of previous observers and also with the general lack of inflammatory and pressure symptoms which characterize the disease, and the absence of peripheral nerve involvement. In three of these (nos. 1, 4, and 5) there was serious impairment of accommodation and the pupils were dilated, sluggish, and at times inactive. In another (case 6) the age prevented accommodation tests, but the pupils presented similar conditions. These four presented other defects: in case 1, there was involvement of other branches of the 3d; in cases 4 and 6, abducens paralysis; and in Cases 1, 2, and 5, facial. While paralysis of both the extrinsic and intrinsic muscles has a tendency towards spontaneous recovery, these cases confirm the observation that the return to normal of the intrinsic is slower than that of the extrinsic muscles.

Of especial interest were the nystagmoid movements, which occurred in five of these seven cases. Indeed, in two cases they were the only signs pointing to involvement of the eye muscles. This nystagmus bore no definite relation to axis of voluntary movement of the eyes. For example, upon lateral movements of the eye as, vertical or rotatory nystagmus might appear.

How are we to explain these various muscular phenomena? The ocular symptoms are clearly of central origin. I incline to the explanation of Melland in explaining the varying clinical phenomena, according to whether the disease manifested itself as an encephalitis inferior or an encephalitis superior. In cases showing ocular muscular symptoms the disease is doubtless a polioencephalitis inferior, with lesions of the brain stem varying from the level of the anterior tubercles of the corpora quadrigemina, along the floor of the fourth ventricle to the level of the nucleus of the sixth nerve. These lesions are probably sometimes irritative, sometimes inhibitory, but never destructive. Paralysis of the intrinsic or extrinsic muscles, governed by the third nerve, is present according to the ganglion cells involved. The nystagmoid movements would thus be due to lesions involving the transverse fibers connecting the nuclei of one side with those of the other, or to lesions involving the posterior longitudinal bundle, which connects the nuclei of the third, fourth, and sixth nerves, or finally to lesions of the association fetus. The character of the nystagmus would vary according to the site of the lesion. It will be recalled that the pathology of lethargic encephalitis is merely a perivascular infiltration, the site of which may vary and the clinical symptoms will likewise vary with the site of the lesion. Paralyses of the facial, of muscles of deglutition and respiration are examples.

As to the cause of the lethargy, English observers have argued as follows, and to my mind this explanation appears very plausible. The slight fever, slight inflammatory changes in the spinal fluid, and absence of other infectious symptoms, make a toxic cause for the lethargy very improbable. The absence of optic neuritis, and other pressure symptoms, together with the generally normal tension of the cerebrospinal fluid, practically rule out increased intracerebral pressure as a cause. On the other hand, the low grade of inflammation about the brain stem might well cut off afferent impulses to the cerebrum to such a degree as to cause stupor. In conclusion, we must remember, however, that the actual cause of the disease is unknown, and the pathology still obscure. The explanations here advanced are those which, in the present state of our knowledge, appear to me most probable, but they are nevertheless, largely hypothetical.

I desire to thank Drs. G. H. Grove and G. E. W. Hardy of the Union Protestant Infirmary staff for their coöperation in observing the cases sent to the hospital.

SUMMARY.

A peculiar disease, termed "lethargic encephalitis," has been appearing sporadically throughout Europe during the last two years and has been observed in this country during the last six months. The disease is characterized by an insidious onset, lack of symptoms of an infectious nature, stupor, and involvement, sometimes paralysis, of various muscles, but chiefly the muscles of the eye or face. The ocular symptoms consist of either relative or total paralysis of the intrinsic or extrinsic muscles, ptosis, and nystagmoid movements. One or several of these symptoms may be present. The ocular symptoms have a definite tendency towards spontaneous recovery.

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OCULAR COMPLICATIONS DUE TO TYPHOID INOCULATIONS.[1]

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IT is with reluctance that I present a subject before this Society, about which there is admittedly some doubt, but as it is not generally known that ocular lesions have been attributable to typhoid inoculations, it seems worth while at this time recording five cases of uveal infections which directly followed these inoculations, and to briefly review the literature of the subject which is exceedingly scant.

Before proceeding with the histories it is interesting to note the opinion of Lt.-Col. H. J. Nichols of the Army Medical School who replies as follows to my query: "No doubt slight effects could be found in certain cases as the eye undoubtedly will share in some of the general reactions, but I cannot believe that these effects on the eye can be of much importance, as among the vast number of men who have been inoculated and followed up in the service, we have no records of any specific damage to the eye as a result of typhoid inoculations, and so far as I know, there is no specific lesion in the eye during a course of typhoid. I have occasionally seen in rabbits corneal opacity following an intravenous injection of typhoid vaccine, but this is a non-specific effect produced by a tremendous dose.".

CASE 1.—Mr. B., age 35, lawyer (now a Captain of Infantry), was admitted to the First Officers' Training School at Fort McPherson, Ga., May 11, 1917, after having passed the usual rigid examination. On May 12th he received the first inoculation against typhoid (a triple saline vaccine). The general reaction was greater than usual and the following day the right eye became a little inflamed, and on the 14th he reported to the post hospital for treatment where he was confined and treated for an acute conjunctivitis. As the eye grew worse I (then in civil practice) was asked to see him. The picture was a typical iritis. The case was very stubborn and the pain was intense. There was no history or evidence of previous eye trouble; he denied lues, but acknowledged an old Neisser infection. A blood Wassermann was negative, but there was a slight positive reaction to a complement fixation test for gonorrhea. Teeth and gums appeared negative, as was the nose and throat examination (no X-ray). He was well, with normal vision on June 17th and was dismissed from the school. He later entered the Second Officers' Training School and graduated. I do not know that he received other inoculations, but I assume that he did.

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[1] Authority to publish granted.—S. G. O., U. S. A. Read before American Ophthalmological Society, Atlantic City, June, 1919.

Case 2.—Mr. L., age 22, entered the same training school May 11, 1917, after having passed the usual physical examinations. I was told that his vision was below standard, but brought to $\frac{20}{20}$ with glasses. He received his first typhoid inoculation (triple saline vaccine) on May 14th; the second on the 20th, and the third on the 27th, with the usual general reaction. On June 1st he reported to my office complaining of blurred vision in the left eye of several days' duration. Vision was $\frac{20}{30}$, there was a slight pericorneal injection, a few dots of keratitis punctata, vitreous opacities, and an area of acute choroiditis about the size of the disk situated below the macular region, and another smaller area between the superior vessels about a disk diameter from the nerve head. There was no previous eye history, he denied lues and gonorrhea, but the blood Wassermann (civil) was positive + +. No other source of infection could be found. In due time he was rejected and returned to his home for treatment.

Case 3.—Negro soldier, Camp Gordon, came to Eye Clinic, Emory University, sometime in July, 1917. A few days previously he had received his second typhoid inoculation (triple saline vaccine) and the left eye became inflamed the following day. Typical iritis. There was no evidence or history of previous eye trouble, and he denied venereal infections. A Wassermann was negative. He was referred to the Base Hospital of his camp for treatment.

Case 4.—Mrs. K., age 40, seen at Emory University Eye Clinic, August 22, 1918, on account of pain in left eye. Two weeks before she took the first inoculation of typhoid vaccine (type unknown), the second a week later, and the third the morning of the visit with the usual reactions. The day after the second inoculation pain developed in the left eye. No history of previous eye trouble or venereal infections. The examination showed a typical iritis, with reduced vision, marked injection, and intense pain. Appropriate treatment. October 7th cured.

CASE 5.—Mrs. E., age 38, seen in consultation with Dr. A. W. Sterling, to whom I am indebted for the early history and for the privilege of reporting the case. The sight has always been defective due to a refractive error. Twelve years ago while nursing a six months' old infant, the left eye became affected and she was treated in a distant city. She did not know the diagnosis, but evidently dionin was used from the description of its reaction. After several weeks the eye was as well as ever. Her history for infection was negative, but she has always been nervous and had poor health. On July 22, 1918, she received the first inoculation against typhoid, and at weekly intervals the second and third dose with the usual reactions. The days after the last inoculation the left eye became slightly inflamed and thinking it was a cold she used household remedies, but as it grew worse and the sight became impaired she consulted her oculist. The diagnosis of uveitis with marked vitreous opacities was made at that time. Most careful physical and laboratory examinations including three Wassermanns were made to determine a cause, with negative results. When I first examined the patient six months after the onset, there was an injection of the deeper scleral vessels, the pupil was dilated, the iris slightly discolored, there were large "mutton fat" deposits on the posterior corneal surface, and a large vitreous mass, which completely obscured any fundus detail. Later the eye has cleared remarkably under thyroid tablets, but a secondary cataract has developed.

Morax appears to have been the first to have called attention to eye complications following typhoid inoculations, for in 1916 he reported his first case of a soldier, with old corneal scars dating from childhood, who developed a violent general reaction with high temperature, with herpes of the brow, eyelids, and cornea, the day after the fourth injection of antityphoid vaccine. Later he reported his second case of herpes of the face and cornea following the third injection of antityphoid vaccine in which the general reaction was intense.

Prelat the same year recorded a case of acute bilateral plastic iridocyclitis following the second inoculation. The Wassermann was positive.

Rousseau later mentions a vesicular keratitis developing after an inoculation of *2cc* of triple typhoid vaccine. The general reaction was violent, and the high temperature headache and inflamed eye developed the day following the inoculation.

Bussey, of the French Medical Corps, who has had charge of the eye service in a section where twenty-two thousand troops were vaccinated against typhoid, reported that five of the men developed ocular lesions thereafter. Two had a nephritis induced by the vaccine; one, a soldier, age 45, developed albuminuric retinitis and died of uræmia; the other presented severe hemorrhage of both retinas. The three other men developed herpes and ulceration of the cornea, but they recovered without impairment of vision. Other articles of a similar nature, by Ginestous and Gloagen, appearing in foreign journals, were not accessible in the Library of the Surgeon General. It is evident that other cases must have developed in the French Army, for in 1917 the French Advisory Military Commission appointed de Lapersonne to investigate whether or not anti-typhoid inoculations could produce eye complications. His conclusions were that some eye cases had been reported which were not well established (especially those cases of acute purulent metastatic iridocyclitis due to faulty technique, poor vaccine, or latent infection in the patient), but there were a few other cases which had been closely studied, and there was strong evidence that the eye complications were directly attributable to the vaccine. He believed that the vaccine itself may produce iridocyclitis in one who previously suffered from this affection, especially when of rheumatic or syphilitic origin. He considered that there was a certain analogy between such an occurrence and the eye reactions which occasionally follow injections of tuberculin and arsenical preparations.

He further believed that there were certain hitherto unexplained lesions of the optic nerve, optic tract, and ocular palsies which may now be explained by a meningeal irritation or infection due to the reaction of typhoid vaccine. And he concluded that in order to admit the action of the typhoid vaccine inoculation, it is necessary that the ocular reaction manifest itself at once or very soon after the injection, and where the violence of the reaction has been demonstrated by the thermometer. And he advises that the patient be subjected to an ophthalmoscopic as well as medical examination, and it would not be advisable to inoculate syphilitic, tuberculous, or arthritic patients who have had lesions of the uveal tract, especially after the fortieth year.

It is known that some cases of acute nephritis, and acute exacerbations of chronic nephritis and chronic pulmonary tuberculosis in our army as well as in the British and French armies, have been directly attributed to the typhoid inoculations. It has been suggested that the number affected is no greater than that normally found in any great body of men who have not been vaccinated. This same argument can no doubt be used against any claim the ophthalmologist might make that eye complications are directly due to these inoculations. But the fact remains that immediately following one of the inoculations certain ocular disorders developed, and circumstantial evidence is too strong to pass it up as coincidental.

One would naturally expect severe constitutional reactions associated with these eye changes; indeed, in many cases they were present, but there were others in which the reactions were normal.

No reason can be assigned for these ocular reactions other than a theoretical statement that the foreign protein contained in these vaccines has a selective action to certain eye tissues, especially the uveal layer, and that certain individuals appear to be extremely susceptible to its action. Just why the reaction in one is more severe than in another is difficult to explain. It can hardly be explained as a reaction of anaphylaxis. The bacterial suspension in the saline solution is comparatively small, yet the general reaction is greater than that of other vaccines and we are forced to accept the consideration that the endotoxin of the typhoid vaccine is the responsible element.

The *British Journal of Ophthalmology* in an editorial two years ago sounded a warning about this same question, and while we agree with the editor that "it is important that all pathological phenomena arising in patients immediately or shortly after inoculations should be thoroughly investigated and that every endeavor should be made to determine if the relation between the vaccination and the subsequent lesions is casual or merely incidental," we believe there is now sufficient evidence to conclude that certain eye complications are directly due to antityphoid inoculations, and that:

(1) The causative factor is an endotoxin derived from the antityphoid vaccine;

(2) Observations of *sequelæ* occurring in other organs following typhoid vaccination lends support to the views herein expressed;

(3) There is an analogy between this reaction and the ocular lesions occasionally seen after the administration of tuberculin and arsenicál preparations.

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SUBRETINAL EXUDATE SIMULATING SARCOMA OF THE CHOROID WITH ANATOMIC EXAMINATION.[1]

By DR. ARNOLD KNAPP, New York.

(*With one illustration on Text-Plate XIX.*)

EYES have been removed on account of a presumptive sarcoma of the choroid and have shown on microscopic examination an organized subretinal fibrous exudate. It seems of interest to put on record another case of this kind and to study the ophthalmoscopic changes with the view of determining whether these changes are definite enough to help in avoiding similar diagnostic errors.

Case History.—P. C., aged 71, presented himself at the Herman Knapp Memorial Eye Hospital on December 20, 1916, stating that the sight in the right eye had been failing for four months. The left eye was poor for some years. R. $\frac{1}{200}$, L. $\frac{10}{200}$. Patient seemed rather emaciated but otherwise healthy. Urine showed a trace of albumin and a few granular casts; the heart was negative, blood pressure 150–80; Wassermann negative. After dilating the right eye there was a sharply circumscribed detachment of the retina just in the macular region. This area seemed to be occupied by a solid subretinal mass which was dull white in color, except in the center where there was some irregular mottling. It showed an elevation of 3 D. The outlines were sharply limited. Diagnosis of sarcoma of the choroid was made and the eye was enucleated.

The *microscopic examination* of the enucleated eyeball showed in the macular region between the choroid and the retina directly springing from the choroid a triangular mass which consisted in the periphery of organized connective tissue, while in the center the tissue was of a more homogeneous structure with fewer cells. Running through the center of this mass there was an irregular line of pigment, evidently the pigment epithelium with numerous gaps and a number of proliferated pigment cells extending into the surrounding tissue. The retina was adherent to this mass, the rods and cones could not be identified, the outer granular layer was scanty with the radiating supporting fibers unduly prominent, being thickened and stretched, often containing amorphous masses. The blood vessels in the retina showed no change and the central vessels in the nerve head appeared normal. The choroid itself seemed normal, except for distended vessels, whose walls were normal, without perivascular cellular infiltration. The mass was directly adherent without being continuous in structure, the character of the tissue changing immediately to flat riband-like connective tissue fibers like hyaline corneal tissue with occasional, poorly-staining, round and spindle cells and amorphous tissue without any particular characteristics. There were occasional blood vessels in the mass. To each side of the mass the separation between pigment epithelium and retina was continued by a granular amorphous exudate lined with pigmented cells.

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[1] Presented before the American Opthalmological Society, Atlantic City, June, 1919.

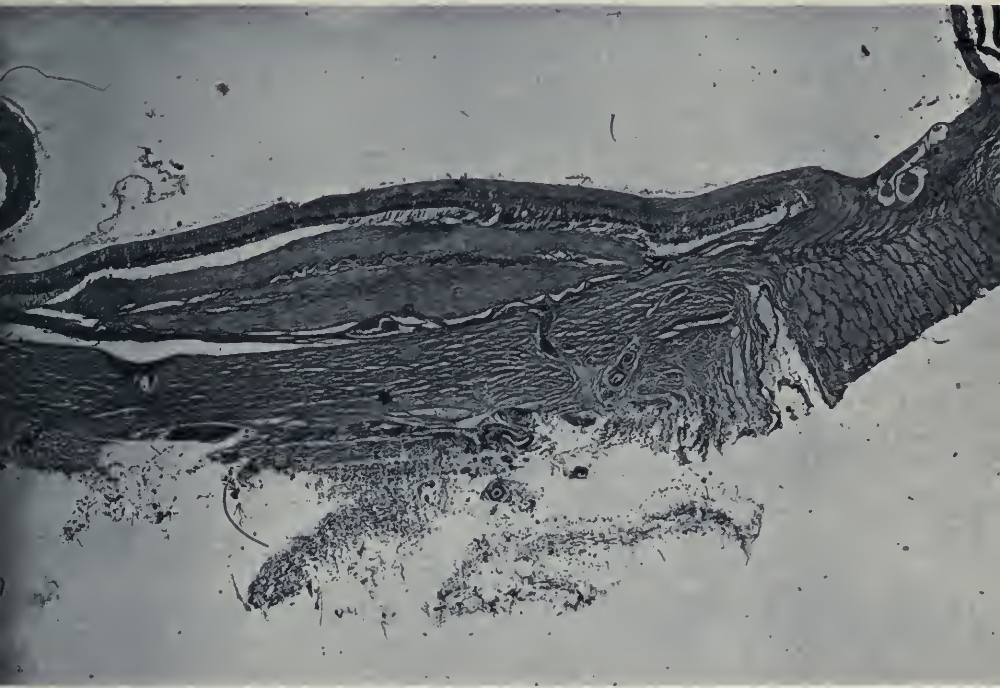
Subsequent history: On August 28, 1918, the patient returned, complaining that the sight in the left eye had gotten worse. The sight was found reduced to counting fingers in six feet, and after dilating the pupil the eye ground presented, in addition to an inferior conus, the following changes in the macular region: On the nasal side there was a triangular deeply placed hemorrhage; adjoining this there was an area of superficial choroidal atrophy. On January 6, 1919, the condition had somewhat changed inasmuch as some dark pigment had replaced the deep hemorrhage, and there were two fresh deep-seated hemorrhages, one above and one below the original area. The patient was again seen on April 15, 1919, and showed, in addition to the pigment and deep hemorrhages in the macular region, chorioretinal changes with deep hemorrhages, connective tissue formation, and sclerosis of the choroidal vessels.

To recapitulate, the mass which was taken for a sarcoma of the choroid, on histological examination, proved to be composed of fibrous tissue presumably the result of either an organized exudate or of a blood clot. The choroid showed no inflammatory infiltration. Its vessels as well as those of the retina were normal.

A case which resembles this closely is that of R. Beatson Hird (*T. O. S. U. K.*, 1916, p. 345) who reported the case of a woman

rch. of Ophthal., Vol. XLVIII., No. 6.   Text-Plate XI

ILLUSTRATING DR. KNAPP'S CASE OF ORGANIZED SUBRETINAL EXUDATE SIMULATING SARCOMA OF CHOROID.



aged 64, in whom the macular region was occupied by a circular pale yellowish-white area, elevated 4 D. The edges were sharply defined; a prolongation extended from one part toward the periphery and three hemorrhages were present in the surrounding retina. The retinal vessels seemed normal. The diagnosis of sarcoma of the choroid was made and the eye was enucleated. The microscope showed a tumor not connected with the choroid, consisting in a mass between the retina and pigment epithelium made up of fibrous coagulum and organized blood clot with extension of epithelial cells into the mass from the pigment epithelium and fissures from cholesterin deposits. A committee consisting of Collins, Parsons, and Mayou pronounced the case as belonging to the type of "retinitis with massive exudation" described by Coats.

Coats (*R. L. O. H. Reports*, vol. xvii., 1908, p. 440) grouped together several cases of retinal exudation sometimes associated with vascular changes occurring in young people whose general health is usually perfect. This author regards the essential pathological change to be hemorrhages in the outer layers of the retina which frequently break through externally, disintegrate, and slowly organize into cicatricial tissue. The cause for the hemorrhages is not understood; the choroid does not play an important part in the process.

Leber ("Retinitis Exudativa," *Graefe-Saemisch-Hess*, vol. vii., p. 2) believes that these changes do not follow hemorrhages but are a deep-seated inflammatory and necrosing process, often associated with hemorrhages, and that there are cases with pronounced choroidal changes. Leber does not accept Coats's view that the fibrin is derived from hemorrhage, because he has frequently observed an extensive fibrinous exudation without any blood corpuscles being present.

Friedenwald (*T. A. O. S.*, p. 819, 1914), in an article on "Retinitis with Massive Exudation," described the case of a young man, aged 18, who showed an extensive retinitis presenting a uniformly white, partly mottled surface, with peripheric hemorrhages, and two prominent masses which resembled choroidal sarcoma; the blood vessels were markedly diseased and there were vitreous opacities. The eye subsequently was enucleated and Verhoeff (*T. A. O. S.*, p. 283, 1909) on microscopic examination found large well-defined areas of hyaline degeneration, apparently following proliferating processes with deposits of lime and cholesterin crystals.

The case which I have just reported differs from those described by Coats, principally because Coats's retinitis occurs in young persons and is generally accompanied with curious vascular changes. Of particular interest are the ophthalmoscopic changes observed in the other eye of this patient, which consisted of chorioretinitis in the macular region with deep hemorrhages and pigmentation, connective tissue formation in the retina, and sclerosis of the choroidal vessels.

Through the courtesy of Dr. H. M. Smith, of Brooklyn, I have recently observed another case of this kind in a man 69 years of age. In the macula there was a sharply defined bluish gray mass with some mottling and 4 D. of swelling. At the upper part there was a large deeply placed retinal hemorrhage. The retinal vessels showed arteriosclerotic changes and in the periphery some of the vessels were obliterated and there were new-formed connective tissue changes. The retina covering the mass showed delicate wrinkling like crackled parchment, a condition which suggests a shrinking of the underlying exudate.

It seems to me that these two cases represent a lesion in the eye ground which belongs to arteriosclerosis. This is characterized by its occurrence in the macular region in patients of advanced years. The ophthalmoscopic picture is that of a subretinal mass, sharply outlined, of moderate elevation, 3 D., bluish gray in color, with some mottling, accompanied by other arteriosclerotic changes in the same or in the other eye.

This condition is of importance in the differential diagnosis of sarcoma of the choroid. It also somewhat resembles the conglomerate tubercle; the latter condition however occurs at an earlier age, the color of the tumor is more yellowish-white, the elevation is greater, and the tuberculin test may show some local changes.

TWO CASES OF EPITHELIOMA OF THE EYEBALL AND LIDS. OPERATION. NO RETURN AFTER ELEVEN AND SIX YEARS.[1]

By DUNBAR ROY, M.D., ATLANTA.

CASE I.—W. A. F., white, farmer, age 54. On June 10, 1908, this patient consulted me on account of a continued irritation and inflammation in his left eye.

Family history showed that father died of cancer and one brother has had cancer of the face but cured by operation.

Present history: Has always been strong and healthy. Eyes have always been good until six years ago when the left eye began to inflame. This has continued ever since with various exacerbations, always becoming worse during the warm weather.

Examination: Left eye: Considerable irritation and redness of both the bulbar and palpebral conjunctiva. Some catarrhal secretion. At the sclerocorneal margin below and to the nasal side there is an elevated gelatinous mass which resembles very much those severe cases of vernal conjunctivitis. Blood vessels were numerous, radiating from the conjunctiva into this mass. The whole sclera was congested. Pupil responded to light and accommodation. The central portion of the cornea and the upper outer quadrant were perfectly clear. There was no pain but some lacrimation. The haze in the cornea extended slightly beyond the edge of the gelatinous growth. Vision was $\frac{20}{50}$. Vision was normal in the right eye and there were no signs of irritation.

Suspecting this growth to be an epithelioma the writer removed the same as thoroughly as possible under cocaine and submitted the growth to the Pathological Laboratory of Emory University. The report received confirmed the clinical diagnosis of epithelioma. The eye healed well, but considerable irritation persisted. The patient was then placed under Dr. Hodgson's care who used ten milligrams of radium as a local application. This treatment was continued at intervals for several months without any material results.

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[1] Read at meeting of the American Ophthalmological Society, Atlantic City, June, 1919.

On February 24, 1909, eight months later, a thorough examination was again made. The patient was suffering with more pain and the whole eyeball was much congested. The gelatinous growth was still present on the cornea and had extended still farther towards the center so that there was very little clear cornea remaining. Vision was reduced to $\frac{20}{100}$. There was more infiltration in the conjunctiva, showing some extension of the growth in this direction. We then decided to enucleate the eye. This was done under ether anæsthesia and at the same time nearly all the bulbar conjunctiva was removed. The cavity was slow in healing and even the small amount of conjunctiva left began to infiltrate. A piece of this was excised and submitted for examination which also showed the epitheliomatous changes.

On March 3d, two weeks later, the whole orbital contents were exenterated leaving the upper and lower lid with every vestige of conjunctiva and cartilage removed. With the ciliæ removed from the free edge, the lids were turned back into the orbit and retained there by packing. The cavity healed perfectly and the denuded bone deep in was finally covered with epidermis.

This patient was seen one year ago and there were absolutely no signs of a return of the growth. His general health was excellent and the whole orbital cavity was smoothly covered with skin. It has now been eleven years since the operation and the result still remains excellent.

CASE 2.—Mrs. Jno. W., white, age 33. November 13, 1913, this lady was referred to me by a dermatologist on account of an epitheliomatous growth extending from the lids to the eyeball.

Family history negative.

Personal history shows that the patient has always been strong and healthy up to two years ago. At that time she noticed a small ulcer at the inner canthus of the left eye at the junction of the skin and mucous membrane. This gradually increasing in size, she consulted a dermatologist. His report showed that there was a negative Wassermann and a portion of the growth excised showed a typical epithelioma. The patient was then treated constantly with varying success. Sometimes the growth would nearly heal and then break down. The treatment consisted of pastes, X-ray, and radium, changing from one to the other as the conditions demanded. For the last month it has not improved and is beginning to involve the conjunctiva, hence this case was referred to the writer.

Examination: The patient shows absolutely no signs of cachexia which I think is perfectly characteristic of this class of malignant growths. A good portion of the lower lid shows a scabby ulceration on the dermoid side of varying extent and form. Its clinical appearance was absolutely that of an epithelioma. On the mucous membrane side there were old cicatricial scars, causing adherence to the ball. The globe itself was very red and irritated. The growth had also extended around the dermoid surface at the inner canthus and had involved the upper lid. This also showed cicatricial adhesions of the inner surface of the lid to the globe. The patient was suffering very intense pain with her eye and there was a marked superficial keratitis. After consultation it was decided that a thorough evisceration of the orbital contents together with an extensive removal of the adjacent skin offered the only hope of relief.

On Nov. 15th, two days after my first examination, the writer performed this operation under ether anæsthesia. A circular incision was made around the rim of the orbit so as to include both upper and lower lids. Internally towards the nose the skin was removed well outside of the growth. The whole orbital contents were exenterated to the apex. All oozing was checked by hot gauze compresses. The whole surface was swabbed with a strong solution of chloride of zinc followed with a packing of iodoform gauze. This dressing was not removed until the sixth day. The cavity looked healthy and the edges of the cut surfaces were beginning to granulate. She remained in the hospital two weeks following which she was brought to my office for the dressings. The same dressings of iodiform gauze were continued every three days with a complete relief of all pain and a healthy healing of the denuded surface. It was remarkable how quickly the cavity from the cut edges began to epidermatize.

Jan. 6th, nearly two months after the operation, the appearances were excellent and the skin surface was rapidly extending to the apex. May 1st, the whole cavity is covered with healthy skin. Just at the apex there was a little moisture. I then advised all dressings to be left off and for the patient to expose the cavity for one hour every day to the direct rays of the sun. In two weeks the cavity looked normal. She then passed from under my observation and a report from the dermatologist told me that two months later the inner wall of the orbit looked a little moist and irritated. This was treated with the X-ray which produced a rapid healing. Since that time, now six years, the patient seems apparently well. I say apparently for time alone can determine whether the cure is permanent.

Remarks: Squamous epithelioma seems to be the only form of carcinoma which offers any chance of cure. Some good results have been reported from the use of the X-ray and radium. It is a well known fact that many cures of epitheliomata of the face have been reported where thorough excision with the knife has accomplished this result. Borch believes that epitheliomata of the limbus arise from the same type of epithelioma that is found in the skin and consequently these tumors should be divided into two classes: Epithelioma arising from nævi and pavement epithelial carcinoma. He thinks the former is much the most common.

On the other hand Fuchs says that if nævi at the limbus begin to grow and develop into malignant tumors it is always a sarcoma that forms from them and not an epithelioma. This author also says, to which the present writer with a limited experience agrees, that it is impossible to make a radical removal of an epibulbar epithelioma or sarcoma and for this reason enucleation or even evisceration should be done as early as possible.

Drs. de Schweinitz and Shumway, before this Society in 1913, reported the history of a case of epibulbar carcinoma, which was somewhat similar to the first case reported by the writer. Enucleation was first performed, followed later by evisceration. After eight months there had been no return.

A review of the literature on the subject has been made by these authors and the writer refers anyone to the same for a more extended review. As far as possible the writer has looked still further into the literature and has found the report of a few additional cases.

However these two, one for eleven years and the other six years, have been observed for a longer period as cured than any other similar cases which the writer has been able to find in the literature at his disposal.

There is some diversity of opinion among authors as to the proper surgical procedure after a diagnosis has been made of these carcinomatous growths. The therapeutic value of X-ray and radium when the growth has involved the eyeball itself is certainly not very encouraging.

However the writer now has under observation a case of sarcoma in the upper lid and in the orbital cavity where he has removed the growth five times. In the last two operations 50*mg* of radium was placed in the wound for four hours, after which it was closed with silk sutures. Radium has since been used externally at various intervals and so far there has been no return of the growth. The first operation was performed six years ago.

On the other hand the early excision of the growth with an endeavor to preserve the eye has not been followed with any marked success. The immediate enucleation of the eye or even evisceration of the orbit if there is extensive involvement of the conjunctiva offers the surest result for the complete eradication of the growth.

A POSITIVE FOCAL TUBERCULIN REACTION IN A SPINDLE CELL SARCOMA WHICH HAD PERFORATED THE SCLERA.[1]

By J. W. CHARLES, M.D., St. Louis.

On July 3, 1918, B. M., 24 years old, a soda water clerk from a small town, came with the following history: Eight or nine years ago the right eye had been burned by powder. It had never given any discomfort until five years ago when the eye had been attacked by a deep pain and the patient had been compelled to stay in a darkened room. At that time he was told by an ophthalmologist that nothing could be done for his vision, which was then nil. The vision of the left eye proved to be $\frac{23}{19}$.

Inspection showed O. D. a ring staphylloma over the ciliary region in its entire upper half with a hazy spot on the cornea, at its upper limbus, the remains of a rather superficial parenchymatous keratitis; also, an almost total exclusion of the pupil in which could be seen a cataractous lens. Movement of the eyes in all directions revealed nothing until the patient looked up, when a small lump was seen on the lower inner quadrant of the sclera which seemed to originate behind the equator, was invisible in ordinary fixation, and which moved with the globe. From its curvature, its diameter was guessed at 1*cm*. Upon interrogation, the patient stoutly maintained that he had first noticed it at least one year ago and he felt sure that it was nearly eighteen months. This fact and the evidences of the old keratoscleritis compelled one to think first of all of tuberculosis because of the fact that usually progress is much more rapid after a perforation by a malignant tumor than had taken place in this case. The Wassermann reaction by Dr. Buhmann was found to be negative with the most sensitive antigen (there was no evidence or history of syphilis) and the patient was referred to Dr. Albert E. Taussig for a diagnostic injection of tuberculin on July 5th. He found no evidences of tuberculosis in the physical examination and gave a subcutaneous injection of three milligrams of A. T. There was no evidence of a reaction until early morning of July 8th, when the patient began to have great discomfort, breakbone aching, temperature of 100.8°; the lump on the sclera was much larger, its estimated diameter being 1¾*cm*, and it was also very red, with a second lobe appearing behind and below it.

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[1] Read at meeting of the American Ophthalmological Society, Atlantic City, June, 1919.

After a disappearance of several weeks, the patient returned with the report that he had been sick in bed for four days with a high temperature, but no symptoms in the respiratory tract (we had naturally thought of influenza). The patient was so loath to have an enucleation performed, although the eye was blind, that a tentative diagnosis was made of a perforating solitary tubercle and the patient was referred to Dr. Taussig for treatment with tuberculin. This was begun with 0.001*mg*, increasing the dose until August 24th, when the patient seemed to have a mild focal reaction after receiving 0.035*mg* and the growth measured in visible diameter 1½*cm* both vertically and horizontally. There was no increase in temperature and a week later the patient confessed that perhaps what made his eye red and swollen was late hours and joy-riding. Dr. Taussig went on his vacation, leaving the patient with Dr. Ross who continued to give tuberculin injections in increasing doses without any effect until the return of Dr. Taussig, October 7th, when 10*mg* were injected because no reaction had followed the administration of smaller doses up to 3*mg*.

On the following day, the growth was much redder with lacrimation and its apparent dimensions were 1¾ x 1½ x ½*cm*—in Dr. Taussig's opinion, "No doubt about a focal reaction."

The patient was immediately sent to the hospital for enucleation. After the conjunctiva had been loosened, the external rectus and the superior muscles were severed and then the optic nerve, thus shelling the globe out without injury to the tumor. This method disclosed next to the nerve a round tumor about the size of a pea connected with the middle lobe of the main growth, and which had existed unsuspected until the operation. Frozen sections from this lobe made by Dr. Ives showed an undoubted spindle-cell sarcoma (*vid.* Dr. Ives's report). No pigment could be found in the sections.

An orbital exenteration was performed by Dr. L. C. McAmis, after which a very small focus of tumor spindle-cells was found in one of the extrinsic muscles.

A course of Coley's fluid was then instituted beginning with ¼ of a minim and increasing at first ¼ daily, then in larger doses until Nov. 5th when 2 M. were given. This was followed by a slight reaction with temperature of 99.8°, pulse 88, and respiration 22; and again on the 8th when the temperature was 99.5°, pulse 90, respiration 20.

On Nov. 12th, with 2½ M. there was no reaction, nor on the 14th with 3 M., and the 16th with 3½ M.; but on the 18th, with 4 M., the temperature was 99°, pulse 74, respiration 20. Coley's fluid was continued every other day in increasing doses until Dec. 3d, when 7½ M. were given without reaction. The patient was then allowed to return home under the care of his physician. The orbital cavity has now almost completely filled out and is well covered, and eight months after the exenteration there has been no recurrence.

Dr. Ives's report follows: "The specimen consists of an eyeball and a tumor adjacent to it. The surface of the tumor is exposed excepting on the aspect adjacent to the eye. The surface is smooth. The tumor is 23 millimeters long and 15 millimeters in its broadest diameter. It is divided into three lobes by shallow fissures perpendicular to the longest diameter. The central lobe is the largest. The tumor is rather firm and the cut surface is gray-white. There is no gross evidence of areas of necrosis.

"Sections show closely packed spindle cells with elongated nuclei. The cells are arranged in bundles placed at various angles to one another. Intracellular substance is inconspicuous. A few blood vessels with thin walls were noted. Mitotic figures are fairly common.

"Diagnosis: Spindle-cell sarcoma.

"Tissue from the orbit: The tissue was examined grossly and one portion suspicious of tumor was taken for sections. This shows what I consider to be spindle-cell sarcoma."

Upon halving the globe in such a manner as to include the nerve and tumor in the same sections, the vitreous cavity was found to be about one third occupied by an almost round white growth which had detached the retina, of which there is left only a strand of tissue from the nerve to the region of the lens. The growth is situated in the lower and nasal portion and the line of the sclera can be distinctly followed in the tumor.

The fact that our ophthalmic technician is still busy in the service has prevented a histological examination of the whole specimen, and we have been compelled to be satisfied with the undoubtedly correct diagnosis by Dr. Ives from the sections taken from the smaller posterior lobe.

A positive focal tuberculin reaction in a tumor originating in the uveal tract is explainable by considering the vascular supply of the growth. Evidently this patient had a uveal tuberculosis which gave a positive reaction, which for our purpose means a congestion in the uvea which simply extended to the tumor. Strictly speaking then the tumor itself was not positive to tuberculin but only the tissue from which it derived its blood-vessels.

The spindle-cell sarcoma is the least malignant of sarcomata and therefore we have more hope that Coley's fluid will avail in preventing recurrence. The patient was seen ten days ago with only a very small sinus remaining open.

It goes without saying that all such blind eyes in which there is any doubt whatever about malignancy should be enucleated at once for diagnosis (taking portions of any tumor for diagnosis is a dangerous practice), but the apparent extreme chronicity in the course of this tumor and apparent focal reactions to begin with, followed by the certain focal reaction October 7th, were misleading.

PERSISTENT POSTERIOR FIBROVASCULAR SHEATH OF THE LENS. A REPORT OF TWO CLINICAL CASES, AND THREE EYEBALLS EXAMINED MICROSCOPICALLY.[1]

By Dr. FRANCIS LANE, Chicago.

From the laboratory and clinics of the Illinois Charitable Eye and Ear Infirmary.

(*With 15 illustrations on Text-Plates Nos. XX.–XXII.*)

CLINICAL observations obtained from two cases of unusual cataract, and the microscopic findings of three bulbs misinterpreted for glioma, convince me that certain so-called pathologic clinical changes of the lens and anterior vitreous often indicate arrested development.

Collins, in 1892, gave a detailed anatomic description of persistent posterior fibrovascular sheath of the lens in three cases, and since then has recognized a like number of cases clinically; to him, therefore, we are greatly indebted for early valuable suggestions offering a clearer understanding of the existence of certain developmental irregularities.

Embryologists agree that the arteria hyaloidea makes its first appearance at the "greatest length" of 5*mm;* a cuticular deposit surrounds the lens vesicle in very early embryonic life, and the posterior capsule is demonstrable as such at the greatest length of 12.7*mm;* the posterior lens vesicle cells have elongated into lens fibers at a length of 13–14*mm*, and the further development of fibers continues from the equatorial region as in the adult; at the beginning of the second month the arteria hyaloidea extends through the entire optic cup as a blood-carrying vessel, and ends anteriorly at the posterior pole of the lens vesicle; in the ninth week the mesodermal capsula perilenticularis goes over into the tunica vasculosa lentis, which at this stage consists only of blood vessels and surrounds the posterior half of the lens. The circulation of blood in the hyaloid ceases, the artery regresses to a solid strand and disappears simultaneously with the tunica vasculosa lentis, respectively during the sixth, seventh, and eighth months.

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[1] Candidate's thesis, American Ophthalmological Society, June, 1919.

No satisfactory theory has been advanced to explain either the incomplete formation of the posterior capsule or the failure of the posterior cells of the lens vesicle to elongate into axial fibers. A too rapid development of the antero-posterior diameter of the secondary optic vesicle, or a failure of the elongation of the arteria hyaloidea to keep pace with the normal axial diameter of the cup, or both, might cause sufficient traction on the proverbially thin lens capsule at the region of the posterior pole to cause a laceration and permanent gap by surface expansion.

An intact capsule is impermeable to all substances except fluids. In the absence of a pigment producing intraocular foreign body, pigmentation in the lens substance must be regarded as hematogenous in origin; all the more so may this be expected if a gap in the posterior capsule exists, and the hyaloid artery persists.

Furthermore, if the hyaloidea develops to unusual caliber one might conceive how it is possible for the undifferentiated mesoderm of the capsula perilenticularis not to disappear, but to follow the laws of development and to proliferate because of over blood-supply, possibly at the expense of lens development, and by so doing favor the persistence of the arteria hyaloidea.

CLINICAL CASE 1.—Joe B., age 14. Dr. Charles Clement permits me to report this case-history, the patient having consulted him because of poor vision and an upward convergent squint of the right eye. The parents did not notice anything unusual about the eye except the squint. This was first observed when the infant was about 1 year of age.

R. V. $\frac{8}{200}$, unimproved under atropine; L. V. $\frac{20}{16}$.

The retinoscopic test in the right eye shows approximately −0.50 in the vertical, and +1.50 in the horizontal.

The nasal ⅓ of the fairly superficial stratum of anterior cortex is irregularly opaque at different levels with contours everywhere well defined. The opacity continues on the mesial side in a more or less fascicular manner, and likewise involves a slightly larger area of the posterior cortex. A somewhat nasally displaced, 4 x 6*mm* oval (horizontally), dense, almost chalk-like opacity without visible vascularization is seen to lie apparently on the vitreous surface of the posterior capsule. (Fig. 1.)

A 3*mm* long, narrow, vertical slit prevails above in this dense opacity, through which a red reflex is clearly visible with the ophthalmoscope, and from the same opacity five or six narrow, spindle-shaped, grayish-white striæ run forward and obliquely in downward and nasal directions. At a level between the cloudy posterior cortex and the deep chalk-white opacity are two somewhat rectangular shaped, unevenly dark-brown areas in the upper and lower nasal quadrants respectively. A reddish hyaloid artery can be traced uninterruptedly from disk to lens, if viewed from the temporal side through the wide pupil. (Figs. 1 and 2.)

Clinical diagnosis: Right upward convergent squint; congenital stationary (?) cortical cataract; blood (?) in posterior cortex; persistent posterior fibrovascular sheath of the lens, with persistent hyaloid artery.

Clinical Case 2.—Peter H., age 6, came on April 24, 1919, to my clinic at the Illinois Charitable Eye and Ear Infirmary on account of poor vision and broad excursions of both eyes. The mother furthermore volunteered the information that sometime during the summer of 1918 a neighbor called her attention to the fact that, "when the light struck his right eye a certain way the pupil 'showed up' white." Upon close questioning, she declared that at no time had the eye been red, and that the child had never complained of pain.

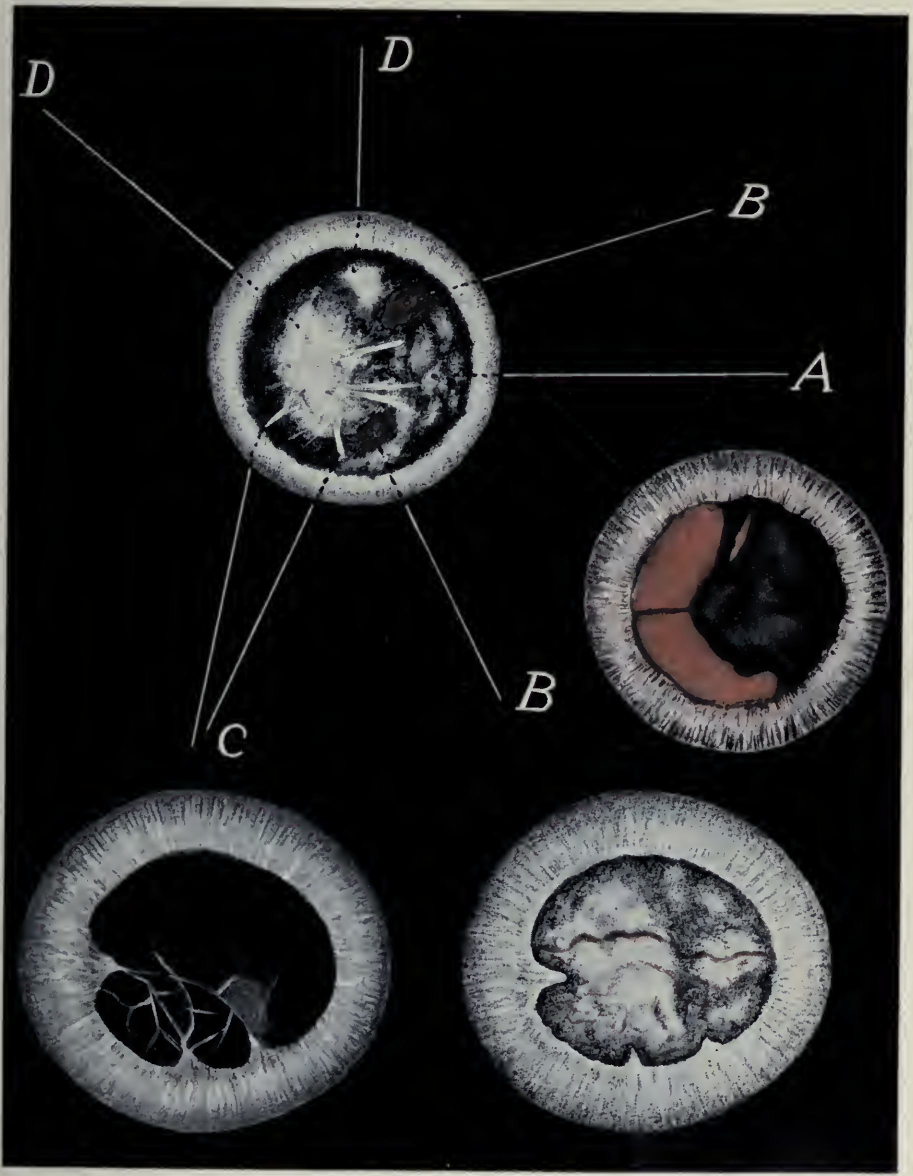
R. V. shadows, no red reflex; L. V. fingers at eighteen inches. Each palpebral fissure measures 21*mm;* both eyes are visibly smaller than normal, and the corneas measure alike, 8 x 9*mm.* The pupillary and ciliary zones of the iris are not definitely demarcated, and a network of delicate pupillary membrane threads stretch across the lower third of the right pupil. (Fig. 3.)

The right pupil dilates under atropine and cocaine (ad max 5*mm*), irregularly below, where three short, narrow, triangular-shaped tags of iris appear to be pulled toward the center by the pupillary threads. No pigment deposits can be found on the anterior capsule. The left pupil dilates regularly to a maximum of 5*mm.*

Completely surrounding the posterior surface of what

Arch. of Ophthal., Vol. XLVIII., No. 6. **Text-Plate XX.**

ILLUSTRATING DR. LANE'S ARTICLE ON "PERSISTENT POSTERIOR FIBROVASCULAR SHEATH OF THE LENS."



ig. 1.

Fig 2.

g.3.

Fig.4.

appears to be a normal lens, one sees a glistening, uniformly white opacity, on the anterior surface of which an evidently single, plainly visible, mildly tortuous vessel of fair size runs completely across in the horizontal meridian. (See Fig. 4.) Four or five much finer vessels, taking the same general horizontal course, are placed below and to the temporal side.

A less dense opacity lies immediately behind the upper nasal quadrant of the left lens, and spreads out behind the upper ¼ posterior surface as a fixed, cobweb-like network. Fundus details cannot be made out, owing to the ocular excursions. A general anæsthetic was denied for examination but I feel satisfied that a hyaloid artery is not present, and that the refractive error is in the neighborhood of +6.00.

Clinical Diagnosis: Microphthalmia, with persistent posterior fibrovascular sheath of the right lens; congenital cataract of the left lens.

The three bulbs to be described present multiple anomalies, but it is my purpose in this paper to confine the anatomic description to those anomalies only which correspond to the structures described in the two clinical cases, *i. e.*, the lens, the posterior lental opacity, and the hyaloid artery.

LABORATORY SPECIMEN A (CASE 3):

History.

When John C., apparently normal baby, became one and a half years of age, the parents first noticed a gray spot behind the left pupil. Dr. Joseph Swan observed a vascularized, white tissue behind the lens of an otherwise comparatively small eye, which, after enucleating for suspected glioma, he gave to me for microscopic examination (Nov. 12, 1907).

Gross Findings.

Left eye, 14 x 13.5 x 13.5*mm;* cornea, 7 x 8*mm.* The bulb was sectioned antero-posteriorly a trifle above the horizontal meridian. The lens, coffee-bean shaped, with the convexity forward, was apparently clear and measured 1.75 x 3.50*mm* with the long axis horizontal. It seemed to set back in a bluish-white semispherical-shaped mass, measuring 2 x 4.25*mm,* from the most posterior convex surface of which a thin thread stretched across the vitreous to the head of the optic nerve. The fine delicate ciliary processes were stretched inward and apparently attached to the most anterior border of that part of the sheath overlapping the equatorial region of the lens.

Microscopic Findings.

The anterior capsule appears normal and the cubical cells continue around the equator, lining the posterior capsule throughout, with the exception of a few neighboring sections at the region of the posterior pole where the capsule appears to be absent, but I cannot satisfy myself that the gap is not an artefact (Fig. 6). The capsule at the equatorial region is swollen to some six microns and wavy, but gradually thins down behind to less than one micron at the posterior pole. Vacuoles, fissures, and small granular masses are scattered throughout the peripheral cortex.

Immediately behind the posterior capsule, a loosely attached, incompact, fibrous-tissue mass extends for at least ½*mm* beyond the broadest diameter of the lens both temporally and nasally. It is poor in cells and elastic fibers, but richly supplied with blood-vessels, many of which lie close to the posterior capsule (Fig. 5). The general direction of the anterior and posterior fibers of the mass is concentric with the posterior surface of the lens; particularly is this true of the posterior set, which has a laminated arrangement, while the intermediate fibers take an antero-posterior course. The hyaloid artery, filled with red blood-corpuscles, enters the membrane a trifle to the nasal side of the posterior pole of the mass, where its lumen measures 0.05*mm;* it then takes a sharp bend to the temporal side, then an axial direction, and divides dichotomously. The lumen of a cross-section of the hyaloid artery, traversing the anterior vitreous, measures 0.03*mm.* The ciliary processes and unretracted retina stretch inward and fuse with the anterior border of the sheath in all sections.

Anatomic diagnosis: Microphthalmia; persistent posterior fibrovascular sheath of the lens, with patent hyaloid artery attached.

Only features differing from those of Specimen A will be regarded in the descriptions of the following specimens—B and C.

LABORATORY SPECIMEN B (CASE 4):

History.

Two months after the birth of L. M., his parents noted that his right eye was smaller than his left, and, as they put it, "the pupil was discolored." When the infant was three months old Dr. Dwight Orcutt enucleated the eye because a shallow anterior chamber and a reddish-gray reflex behind the lens suggested glioma (Jan. 27, 1908).

Gross Findings.

Right eye, 15 x 16 x 15*mm;* cornea, 8 x 9*mm.*

The pupil was round, 4*mm* across, and the entire body of the iris was pushed forward and apparently applied to the posterior surface of the clear cornea. A superior calotte was made, the vitreous was clear, and a delicate, light colored, threadlike strand began at the center of the optic nerve and ended at the center of a dense white disk on the posterior surface of the lens. With the binocular loupe the dark-lined, lengthened, ciliary processes with the unreceded retina could be seen to extend inward to the white disk behind the lens.

Microscopic Findings.

All sections show the anterior stroma of the iris passing beyond the pupillary border and becoming attached to the anterior capsule. In some specimens the entire thickness of the iris margin bends backward at right angles, but in none of the sections is there any evidence that such adhesion is caused by plastic inflammation (Fig. 7).

The cubical cells and capsule surround the entire circumference of the lens except the region of the posterior pole, where a gap in the capsule is present. A spindle-shaped, brown, finely granular structure, surrounded by pigment-bearing connective tissue cells, enters the gap, on both sides of which are a number of vacuolated cells and granular masses (Fig. 8).

Irregular, brownish areas, one quite large, dotted with small, deep-staining nuclei, are found farther forward in the cortex. (Blood ?) (Fig. 9.) The sheath behind the lens is more intimately adherent to the posterior capsule, far more cell-rich, and somewhat more vascular than that described in Specimen A. The cells consist of three types—those most posteriorly in the laminated area are markedly elongated and spindle-shaped, those in the body of the sheath are mostly oval, while anteriorly are many small round cells usually grouped about the blood-vessels. Small and abnormally large, wavy, interlacing fibers springing from the sheath and hyaloid artery (arterial diameter $\frac{1}{20}$*mm*) permeate the anterior vitreous. The ciliary processes are matted in the border of the sheath in all specimens (Figs. 10 and 11).

Anatomic diagnosis: Low grade persistent pupillary membrane; persistent posterior fibrovascular sheath of the lens, with gap of the posterior capsule; hemorrhage in the lens; persistent hyaloid artery.

LABORATORY SPECIMEN C (CASE 5):

History.

Dr. Oscar Dodd examined baby G., an infant three months old, and noted that the left lens was pushed forward on the nasal side, and a gray, vascular tissue was situated in the most anterior region of the vitreous. The tests with the ophthalmoscope and transilluminator suggested a new-growth, and the eye was enucleated for fear of glioma (Nov. 15, 1912).

Gross Findings.

Left eye, 17 x 16.5 x 16.5*mm*.

The lens measures 3 x 5.25*mm*, and the posterior sheath, displaced temporalward, is ⅛*mm* thick at its greatest diameter (Fig. 12).

Microscopic Findings.

The capsule is entirely absent at the region of the posterior pole. (Fig. 13). Elongated cells and fibers from the sheath press forward into the opening for a short distance, and several near-by areas of cortex show beginning calcification. Vacuolated cells and nucleated lens-fibers stretch forward and temporalward from the connective tissue filling the gap (Fig. 14.)

The distinguishing feature of this eye lies in the fact that on the nasal side the lens-fibers are laid down normally from the equatorial region, the ciliary processes are normal, and the boundary line of the ora serrata is normally placed; whereas, on the temporal side the lining cells of the capsule continue backward to the gap, the elongated processes with the retina stretch behind the iris and fuse with the border of the posterior fibrovascular sheath (Fig. 15). So far as I am aware no like observation of the lens, ciliary body, and retina has been recorded to date.

Anatomic diagnosis: Persistent posterior fibrovascular sheath of the lens, with hyaloid artery; partial irregular development of the lens, limited to the temporal portion, constituting marked asymmetry.

As for treatment, it has been suggested that a needling, or for that matter a series of needlings, be per-

578'

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ILLUSTRATING DR. LANE'S ARTICLE ON "PERSISTENT POSTERIOR FIBROVASCULAR SHEATH OF THE LENS."

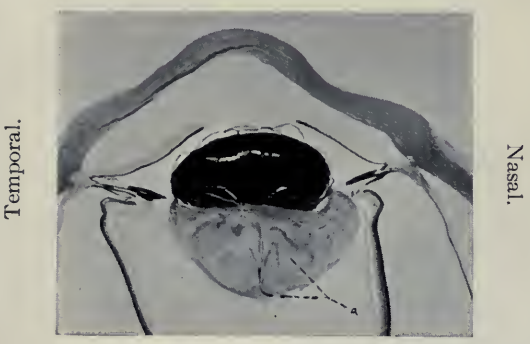

Fig. 5. Lab. Spec. A, Case 5.

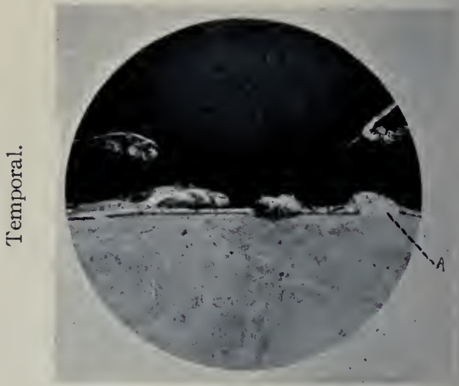

Fig. 6. Lab. Spec. A, Case 3.

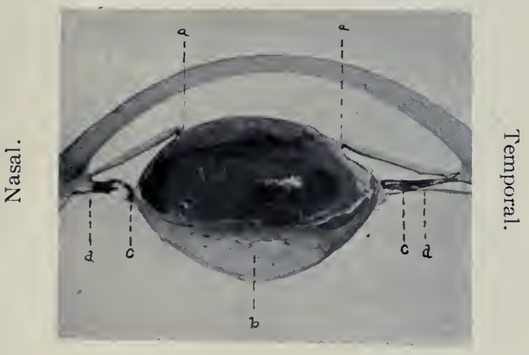

Fig. 7. Lab. Spec. B, Case 4.

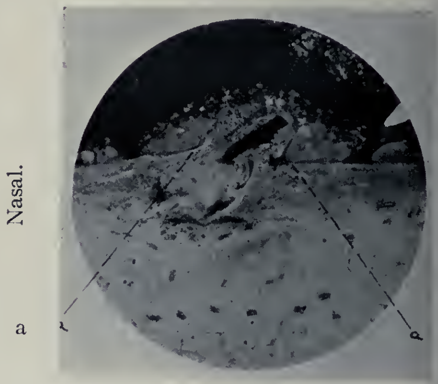

Fig. 8. Lab. Spec. B, Case 4.

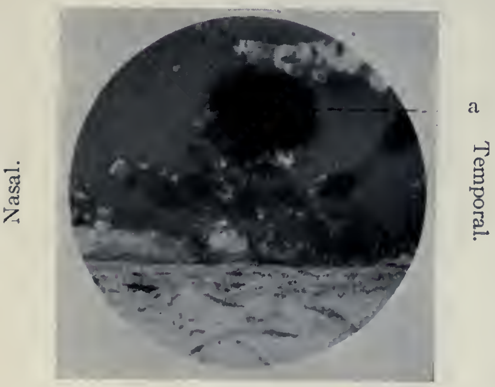

Fig. 9. Lab. Spec. B, Case 4.

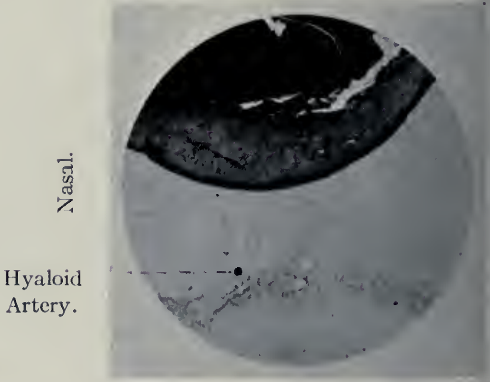

Fig. 10. Lab. Spec. B, Case 4.

Illustrating Dr. Lane's Article on "Persistent Posterior Fibrovascular Sheath of the Lens."

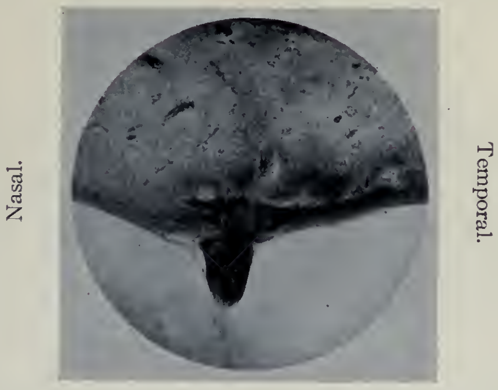

Fig: 11. Lab. Spec. B, Case 4.

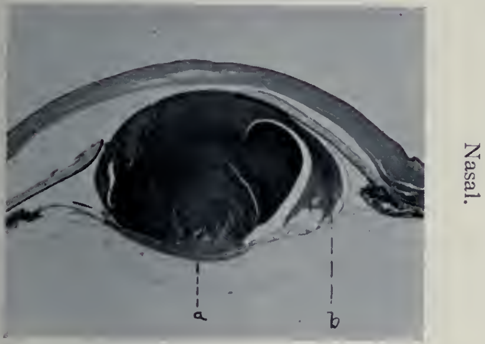

Fig. 12. Lab. Spec. C, Case 5.

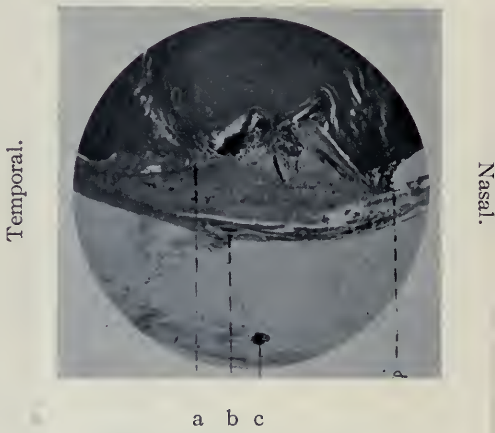

Fig. 13. Lab. Spec. C, Case 5.

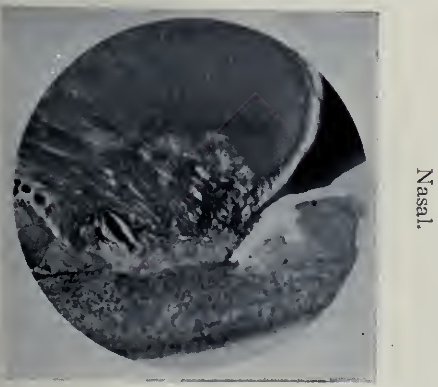

Fig. 14. Lab. Spec. C, Case 5.

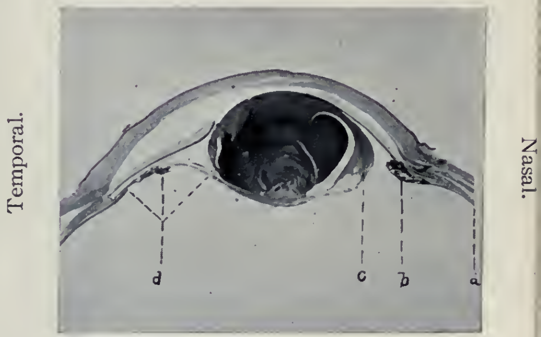

Fig. 15. Lab. Spec. C, Case 5.

> formed in the ordinary way to attain the absorption of the soft lens material. After this has been accomplished the sheath must be dealt with, because it is unaffected by contact with aqueous.
>
> Dilacerations have been done to no avail, because the elasticity of the membrane prevents retraction of the severed surfaces. Collins advises that the mass be deliberately pushed downward and backward into the vitreous cavity. (1908.)

Should such a procedure have been successful in Cases 4 and 5, I am convinced that the anatomic relationship would have been so seriously disturbed, owing to the fusion of the sheath with ciliary processes and retina, that the eyes would have been lost from intraocular hemorrhage or glaucoma.

CONCLUSIONS.

(1) Assuming that the existing condition of the two clinical cases is congenital, it is certain that had they been examined during infancy or early childhood, the question of glioma would have been considered.

(2) An opaque, vascular tissue behind the lens, whether completely or incompletely surrounding the posterior capsule in eyes presenting evident congenital anomalies, should strongly suggest the possibility of a persistent posterior fibrovascular sheath of the lens.

(3) Pigment, particularly in the posterior portion of the lens, and a post-lental vascular membrane suggest a congenital defect of the posterior capsule and hemorrhage in the lens material.

DESCRIPTION OF FIGURES.

Fig. 1. (a) Anterior cortical cataract; (b) hemorrhage in posterior cortex; (c) striæ radiating forward; (d) persistent posterior fibrovascular sheath.

Fig. 2. Hyaloid artery.

Fig. 3. Persistent thread-like pupillary membrane.

Fig. 4. Persistent posterior fibrovascular sheath of the lens.

Fig. 5. (a) Persistent posterior fibrovascular sheath of the lens, with entrance of hyaloid artery.

Fig. 6. (a) Gap (?) of posterior capsule.

Fig. 7. (a) Persistent pupillary membrane; (b) persistent posterior fibrovascular sheath; (c) elongated processes; and (d) unretracted retina.

Fig. 8. (a) Ends of posterior capsule, with gap wedged by connective tissue.

Fig. 9. (a) Hemorrhage in lens.

Fig. 10. Vitreous fibers originating from the fibrovascular sheath, and hyaloid artery.

Fig. 11. Fibrovascular sheath, with entrance of patent hyaloid artery.

Fig. 12. (a) Persistent posterior fibrovascular sheath of the lens; (b) normal development of lens-fibers at the equator.

Fig. 13. (a) Ends of posterior capsule, with gap filled in with connective tissue; (b) entrance of patent hyaloid artery into sheath, with vitreous fibers coming from sheath, and (c) artery.

Fig. 14. Vacuolated cells, and nucleated fibers anterior to connective tissue filling gap.

Fig. 15. (a) Ora serrata; (b) normal ciliary processes; (c) normal lens-fiber development; (d) embryonic ciliary processes with unreceded retina fusing with sheath on temporal side.

ANTIDIPHTHERITIC SERUM IN SEVERE OCULAR INFECTIONS WITH SPECIAL REFERENCE TO HYPOPYON KERATITIS.[1]

BY DR. BEN WITT KEY, NEW YORK.

INTRODUCTION.

THIS branch of ocular therapeutics (serum therapy) has been characterized, more so than any other perhaps, by the most conflicting opinions and varied observations, the most enthusiastic—too enthusiastic—on the one hand, and the most conservative—too skeptical—on the other. And since Wright announced his theory of opsonins and formulated the opsonic index of phagocytic activity, investigators of every country have striven by every means of modern research to standardize bacteria and their many kindred strains, to classify their peculiarities, to measure the virulence of each, to minimize and increase this virulence, and to utilize them at will by innumerable methods of vaccination and inoculation for diagnostic, prophylactic, and therapeutic purposes. And the result of these investigations has been, that certain therapeutic means have been entrusted to the ophthalmologist, which have broadened his field of usefulness and made more directly curative the systemic ocular conditions constantly under his care and direction. For example, may I point out, briefly, the most important of these—the oldest of all methods of immunity, originated by Jenner, that of smallpox vaccination and its well-known far-reaching influence on the frequency of blindness; also the healing action of Behring's antitoxic diphtheritic serum upon conjunctivitis produced by Loeffler's bacilli; the effect of antitetanic serum occasionally indicated in ophthalmology; the theory and practice of serum therapy in hay-fever that is of peculiar interest to the ophthalmologist, since the use of Dunbar's "Pollantin" and Weichart's "Graminol" to the employment of those preparations, more definitely and specifically active of the present time. The Jequiritol-serum of Roemer, to combat violent Jequiritol-ophthalmia and to prevent complications, is classed as an antitoxic serum in this branch of ocular therapeutics. The field of bactericidal serum therapy, in which the pneumococcic serum of Roemer and Merk and the polyvalent serum of Roemer and others have been exploited and employed with varying results due to the practical difficulties in obtaining an autogenous or specific effect against the particular strain of organism, the same being true of streptococcal and staphylococcal serum or vaccine, the means of active immunization with vaccines from microorganisms cultivated from the eye of the patient are theoretically most acceptable, but in practice most difficult and uncertain to carry out. The gonococcic serum or vaccine effect upon metastatic iritis has proved to be most efficacious in the hands of those who have employed it, in contradistinction to its effect upon conjunctivitis where theoretically and practically the vaccine or serum has seemed ineffectual. Flexner's meningococcic serum is useful in ophthalmology through its favorable influence on the general disease; and finally, the tuberculin treatment of ocular infections as practiced by Von Hippel, Percival Hay, Maitland Ramsay, Weeks, and many others, and which has become through careful clinical observation of innumerable cases, and under the care and varied treatment of many reliable observers, a therapeutic measure of value not to be estimated.

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[1] Candidate's thesis, American Ophthalmological Society, 1919. Full report of the case histories appears in the *Transactions of the American Ophthalmological Society*, 1919.

When one recalls, then, these important therapeutic agents offered to the ophthalmologist through long continued experimental and clinical investigation, one is struck by the value of them and by the records and results, and one is stimulated to carry on, within conservative limits, the study and research of serum therapy. Following upon and coming out of the study and investigations just related, the theory and practice of para-specific therapy has been evolved. This field, like that of the proteins, is opposed to or unexplained according to known standards of bacterial activity in the human body. Experimental and clinical results have not coincided. The older theories of immunity have not explained the results claimed by the practice of para-specific therapy. On the other hand, clinical observations of its effect have not met the demands of the fundamentals of bacteriology. The question, therefore, of the place in ophthalmology to be accorded para-specific therapy and the theory of its activity, if any, is one not as yet definitely determined.

LITERATURE.

Ophthalmic literature, since 1907, is fairly crowded with the theories, experiments, and clinical observations of many authors on this subject. Darier, perhaps more than any other, has championed the cause of para-specific therapy, and through the reports of his results, encouraged the practice of it by numerous collaborators, who more or less confirmed his findings, while at the same time he provoked a storm of criticism from those closely adherent to bacteriological principles. And so two schools of writers and investigators have arisen, who seem far apart in their theories, farther apart in their experiments, and farthest apart in their observations and analysis of results. The one holds that the use of antidiphtheritic serum in nondiphtheritic conditions of the eye is opposed by the accumulative evidence of the strictly specific reaction of the tissues against poison and foreign substance of every kind; also that it has no effect upon the opsonic index of the experimented animal, nor does it increase agglutination or complement fixation; in other words that purely experimental observations have not demonstrated that diphtheritic antitoxin is able of itself to combat nondiphtheritic ocular infections. Axenfeld (Freiburg), Happe, and von Szily made experimental tests on rabbits by previously immunizing and also treating them daily after infection with relatively large doses of Behring's and Roux's serum. Accurately measured minute quantities of culture of staphylococci or pneumococci were injected into the anterior chamber or cornea. A control rabbit was always injected in the same manner. These experiments had a completely negative effect. When the injections of pneumococci were made into the vitreous the rabbits not only developed panophthalmitis, but died in a few days, exactly as did the control animals. They concluded from these experiments that the serum did not exhibit any influence against either local or general infection (*Ophthalmological Review*, page 67, 1919). It is admitted, however, that these experiments do not solve the question for the human subject. Knapp and von Michell (*Klin. Monats. f. Augenheilkunde*, 1909) warned their contemporaries against the enthusiasm over para-specific therapy, no specific results having been observed by them. Roemer (*Ophthalmology*, page 158) states that "it is self-evident from the difficulties that beset the specific etiological therapy that a nonspecific serum therapy is hopeless in ulcus serpens. Furthermore, that this fact was to have been expected from the results of the study of immunity, for there is no scientific foundation for the idea that such nonspecific serums as diphtheria serum and Deutschmann's yeast serum can possibly produce any effect upon a pneumococcal infection of the cornea." E. Janson experimented with normal rabbits and those previously treated with diphtheritic antitoxin. He used B. typhosus and para-typhosus for the agglutination experiments, and for the others he used the staphylococcus and pneumococcus. As regards agglutination, complement fixation, and opsonic index, there was no appreciable difference between the serum of the treated and the non-treated animals. Neither was there any beneficial result from treatment of experimental infections of the anterior segment of the eye. Bietta and Cavara have concluded from their work on animals, that antidiphtheritic serum is ineffective for combating postoperative experimental infections, both when injected under the skin and when administered by mouth. Neither do they believe clinical experience clearly demonstrates that antidiphtheritic serum is able of itself to combat ocular infections. The same conclusions were reached as regards experimental research with Deutschmann's serum E. and his serum D. There was no difference in the opsonic index and no change in the agglutinating power in the treated and nontreated animals.

On the other hand, Darier and his followers maintain that para-specific therapy is a means of defense of the organism in all infections, local and general; that antidiphtheritic serum is the most trustworthy of the serums employed, because of its potent eutrophic, stimulant, and anti-infective properties. They claim that its action on the organism is by its potent effect upon all the anatomic elements by placing it "in a state of defense distributed, each after its manner in the circulation,—antitoxins, immunisins, and antibodies. The glandular elements—thyroid, suprarenals, spleen, liver, testicles, and lymphatic nodes, as well as the nervous, muscular, and osseous tissues—are all in a state of organic hyperactivity." Predtetschensky insists that the antidiphtheritic serum contains "stimulins" (substances that stimulate the leucocytes to increased activity), as do other certain substances such as concentrations of nuclein acid, etc., and also horse serum (Axenfeld). Peabody, Rosenberger, Randle call attention to the effect of antidiphtheritic serum upon meningococci and state the effect is "antagonistic" and inhibits their growth similar to the action of certain microbes in nutritive media in consequence of the presence of other germs. Deutschmann has reported experiments with his yeast serum upon animals after infecting the anterior chamber with staphylococci, streptococci, pneumococci, or tubercle bacilli and the effect was markedly favorable in the rabbits infected with pneumococci. M. Neisser discovered that yeast serum in the vitreous stimulates somewhat the action of leucocytes against staphylococci, thus increasing phagocytosis. The partisans of para-specific serum therapy do not deny or doubt the specific nature of antitoxin and of the other specific antibodies, but they do adhere to the theory of para-specificity, because the process of antibacterial immunization is by no means explained by hitherto ascertained specific effects and go so far as to claim that probably the whole therapeutic effect of streptococcic and pneumococcic sera and others is an effect that may not be in itself sufficiently specific, but also acts by its nonspecific stimulating and other properties. Antidiphtheritic serum, anti-tetanic yeast serum, and normal horse serum are said to act similarly on the human subject. Of these antidiphtheritic serum has been the most popular, although whatever effect or advantage is claimed of one is accepted as an argument to some extent in favor of all—the theory of para-specific therapy.

The accumulative evidence of clinical observation alone seems to rest on the side of para-specific serums, judging by the reports of numerous authors who have employed them. Axenfeld remarks "that clinical observation on human subjects must always speak the decisive word, although by it no mathematical certainty can be obtained and also something of subjectivity always clings to it. It is possible that a result which we do not obtain in animals may nevertheless occur in the human body." Darier heads the list of those using antidiphtheritic serum, having employed it in hundreds of cases and with results that appear unusual. His experience dates back to 1904. In *La clinique ophtalmologique*, he repeatedly defends himself and his convictions, and in this publication for 1910, p. 131, he states that his own enthusiasm during the past three years has been experienced and met with almost simultaneously in Germany and France and with absolutely different serums, and that the specific effects obtained by Roemer with his antipneumococcic serum were not as numerous or as favorable as those obtained by himself with antidiphtheritic serum or by Deutschmann, von Hippel, and Zimmermann with yeast serum and horse serum; and furthermore that the cases were now so numerous that there was no longer any doubt as to the real efficacy of para-specific therapy.

As early as 1907, Deutschmann published his experience with his yeast serum, and since that time has reported results so striking, that he has been taken to task on numerous occasions for statements difficult of acceptance. At the same time, 1907, Darier was experimenting in a similar direction with the serum of Roux and Behring, and was beginning to report most favorable results, obtained in conjunction with the usual local and surgical treatment of infections of the eye. M. Teulières, in the same year arrived at results similar to those of Darier in the use of antidiphtheritic serum. In 1908, Axenfeld threw a chill over the enthusiasm of those reporting such brilliant clinical results without experimental evidence to prove what they claimed, and appealed for a high standard of experimental and clinical work. At the same time, Happe presented the result of 100 experiments on rabbits, including infections of the vitreous, anterior chamber, and cornea, and concluded that the value of Deutschmann's serum and antidiphtheritic serum had not been demonstrated by his experiments. Zimmermann reported eleven cases in which wounds and ulcus serpens were greatly benefited. Antonelli believed from his clinical experience that "nothing was to be feared" from the use of antidiphtheritic serum and that his results especially in severe wounds of the globe led him to advocate it. Teulières in this year concluded that the serum of Roux was undoubtedly beneficial when used in conjunction with the usual local treatment. Bailliart reported four cases of hypopyon keratitis in which he believed the result from antidiphtheritic serum was strikingly favorable. In 1909, besides Darier, who reported a large series of miscellaneous cases which he claimed to have benefited by antidiphtheritic serum, Scheuermann presented eight cases following trauma; Dehenne and Bailliart reported post-operative infections; and Dorr used it in accidental injury cases, all having noted favorable action of the serum. Deschamps reported a severe suppurative iritis following grippe and Heydar-Bey a post-grippal neuroretinitis. Angiolella reported five cases, Frogier twelve cases, Zimmermann twenty-eight cases; these observers meeting with and believing in effective results from the serum. Fernandez, J. S., ventured the use of the serum as a prophylactic measure in injuries both accidental and operative. In 1910, Deutschmann presented 117 cases treated by his "polyvalent yeast serum" and in which he claimed definitely good results; von Hippel also reported such glowing results with Deutschmann's serum that Axenfeld criticized them as being evidence of doubtful significance. Weeks in presenting the status of serum therapy in ophthalmology at Budapest was noncommittal as to the nonspecific use of diphtheritic antitoxin. During this year favorable results from nonspecific use of antidiphtheritic serum were reported by Alexandroff, Menacho, Jacqueau, Fernandez and Yvert, Piccaluga, and others. In 1911, Kasas refers to the effect of diphtheritic serum on the symptomatology of corneal ulcer and inflammation of the iris in the cases of his experience, and is impressed by the relief of pain and the definite improvement in the healing process following the use of the serum. Mayweg reported a case of panophthalmitis which was relieved by antidiphtheritic serum and so checked in its progress that it was unnecessary to enucleate. Darier grows bolder in urging the serum in iritis, whether tubercular, syphilitic, gonococcal, or rheumatic and suggests the use of it by mouth. During 1912, Darier, Janson, and Dorr reported further investigations, Janson giving the results of experimental work that proved the negative effect of antidiphtheritic serum and decrying the enthusiasm of the French writers, while Dorr presented 36 cases of grave corneal ulcer favorably affected by yeast serum. In 1913, Solm, R., reported experiments on rabbits with pneumococcic serum and without any result whatever, but on the other hand in man the serum showed definitely curative properties in panophthalmitis and other suppurative inflammation in which he employed it. He administered it by mouth in large doses and hypodermically. In 1914, Darier employed antidiphtheritic serum at the earliest moment in severe infections of the eye, during the period when a bacterial diagnosis is being made and during the time necessary to prepare a specific serum. This relieves pain and is usually so effectual that specific serum may be unnecessary. He urges the administration by mouth. Ribas Valero reports in detail a case of corneal abscess that resisted the usual classical treatment, and after injection of 4000 units of antidiphtheritic serum, in 72 hours there was disappearance of the purulent infiltration with marked lessening of reaction and relief of pain. During 1915, Frogier recommended oral administration of antidiphtheritic serum, and relates a wide experience in the use of the serum for paraspecific purposes. He finds it gives constant results in the relief of pain, has a definite analgesic and euphoric action, checks the infectious process, and assists in the resorption of infiltration and exudates, and in the repair of tissues. Lafont, Dupont, and Heckenroth report a series of cases treated with sera, and in forty-nine of them were most favorably impressed by the treatment. Bietti and Cavara in this year reported their experiments already referred to.

ADMINISTRATION AND DOSAGE.

Diphtheritic antitoxin has been administered hypodermically, intravenously, by the mouth and by subconjunctival injection. It was at first employed, as was originally intended for specific purposes, by hypodermic use, and it was through this method that its apparent beneficial effect was first noted. Through a larger experience, evidently as a result of anaphylactic effects in certain cases, the oral administration has been strongly urged by its most ardent supporters, with the assurance that no general ill effects have been observed from this method and that clinical results are equally as good. Darier has advocated the subconjunctival injection in desperate cases, but his enthusiasm in this direction has not been shared by others for reason of its ultra-unscientific basis, other than by increasing local irritability and cell activity capable of any other irritating solution. Undoubtedly there have arisen anaphylactic effects sufficiently alarming to suggest the oral administration of the serum, although I have failed to find such reports in the literature. Many have observed a slight rise of temperature even to the degree of 103, with nausea, some gastrointestinal disturbances, an occasional erythema, joint pains, restlessness, etc., but which disappeared rapidly and without serious consequences. On the other hand so frequently has it been employed and without the least complication, that it is reasonable to suppose one may become careless and bold in the administration of large doses, and certain individuals sensitive to its action may suffer severely, even fatally from it. Darier claims that the antidiphtheritic serum has an action ten times more intense than normal horse serum. With 10*cc* of the serum of Roux, one obtains an effect, he says, equal to 100*cc* of horse serum. He concludes (*La Clin. Opht.*, 1913, p. 422): 1st, That with the rabbit some grave infections have been favorably influenced by serum given by mouth or by injections. In man panophthalmitis has been benefited and many other cases have been cured by the serum given by mouth. 2d, Purulent infections of the eye have been influenced more vitally and better by serum given by mouth than by injections. 3d, For prophylactic purposes the subcutaneous injection is preferable. 4th, 10 to 25*cc* a day by mouth at the first signs of infection almost invariably effects a complete cure. Mongour and Fonquet in their book *Sérum de Cheval Normal en Thérapeutique* draw the following conclusions: Horse serum is chosen by preference because it exposes less than all others to anaphylactic accidents. 1st, It activates the coagulation of the blood, therefore is indicated in hemorrhages and more particularly in hæmophilias. 2d, It activates the hæmapoietic system and therefore is valuable in anæmias. 3d, It stimulates general phagocytosis, thereby explaining the influence upon infections and intoxications. 4th, It favors local diapedesis of white cells, thanks to its chemotactic properties, therefore is employed in burns and also in peritonitis. Furthermore they conclude that the administration by subcutaneous and by intravenous methods exposes to anaphylactic accidents, but this is not the case when given by mouth. They add that for want of normal horse serum, so difficult to obtain, one may utilize the antidiphtheritic serum which gives exactly the same results and contains the same properties.

As to the time of administration, the serum has been given at various times relative to the severity of the involvement and the employment of other treatment. It has been especially urged that it be given at the earliest possible moment after hospital treatment is demanded. The earlier the treatment is begun the more effectual is believed to be the result. Darier and his followers insist that it is often given too late just as antitetanic serum and antidiphtheritic serum for specific purposes are often administered after permanent destructive changes have taken place. On the other hand they believe that it is in the grave cases of infection where the usual local treatment, however intensely applied, may fail, that the para-specific effect administered early is of the most value. Therefore it is urged that every case be treated early, but the effect in grossly neglected cases is remarkable. As to frequency of administration, there is difference of opinion, Darier giving by mouth a moderate dose every day for three or four days. He also advocates hypodermic injections of a moderate dose every other day for three doses. Others rely upon one dose of large amount, while others have employed it every day in moderate amount by the hypodermic method. Zimmermann (Goerlitz) believes that if improvement is not definitely noted in three or four days after injection, no effect will be obtained by this therapy, but he has reported remarkable results from two injections only, and believes the effect is transient and not at all cumulative. Others share this opinion.

The usual interval between doses has been from one to three days, and I have found no instance where seven days has intervened. Together with administration of the serum, many forms of local treatment have been employed, depending for the most part on the severity and extent of the process involved in the individual case—the classic treatment of hot fomentations, atropine and local antiseptic measures, cautery (chemical and galvanic), paracentesis of cornea, transfixion of Saemisch, conjunctival autoplasty, strong dionin solution, subconjunctival injections of antidiphtheritic serum, or of salt solution, or of cyanide of mercury.

As to the dose to be administered, there are many opinions. In 1909, Darier recommended the injection of 10*cc*, equivalent to about 2500 units, and repeated every day for three days. Later, in 1913, he advocated 20*cc* by mouth, and frequently only 10*cc* in eleven times the amount of physiological salt solution by mouth was sufficient, but it may be repeated every day for three or four days if necessary. Verrey and Frogier after very large experience regard the administration of 10*cc* of serum in 110*cc* of salt solution by mouth as the best and most effectual of all the means and dosage. Piccaluga employed 800 units by hypodermic. Fernandez employed 2000 and 1000 units; Castresana (Madrid) used intravenously 10*cc* in 100 grams of solution saturated to 7%; Jacqueau (Lyon) varied the dose with the gravity of the infection, usually employing 10*cc* every day for four days. Alexandroff never gave more than 10*cc* for four injections. Zimmermann maintains that small doses are just as efficacious as, if not more so than, large doses; that 1500 units is usually sufficient and he has found it necessary to repeat it rarely. In this connection he reports 28 cases of hypopyon ulcer and infections after trauma, in which 17 cases were given only 1500 units, 3 cases given 2500 units, 5 cases given 3000 units, and 3 cases given 4000 units in all, not more than 1500 units being employed at a dose. Large doses of the serum have been administered, but those observers who have had largest experience have shown a definite preference for smaller doses repeated every day or two for three or four injections. Ribas Valero used 20*cc* hypodermically, and also Angiolella gave injections of 5000 units, both reporting very striking results. The advocates of large doses base their reasoning upon the theory of nonvascularity of the cornea, aqueous, and vitreous, which therefore require larger doses than disease elsewhere, it being claimed that these doses cause no harm and aid the ocular process by producing a negative phase of cellular activity. The minimum dose used, so far as I have been able to find, has been 500 units, while the maximum dose was 8000 units. In all the least amount regarded as necessary in a single case has been 800 units, and the maximum 15,000 units. The minimum time before a change has been observed after administration of an injection was twelve hours (this after a large dose and also after a moderate dose), the maximum time was seventy-two hours, the usual time being twenty-four to forty-eight hours. The maximum time over which the serum has been employed in a single case was six weeks, injections being given at infrequent intervals.

INDICATIONS.

The broad field of usefulness to which para-specific therapy, especially antidiphtheritic serum may be employed, should it deserve a place in ophthalmic therapeutics, is quite evident even to the casual observer. Axenfeld (Freiburg) stated at the Sheffield meeting of the British Medical Association (1908): "If one or other of the nonspecific sera should really prove so polyvalent that it is capable of acting at the same time against a number of different bacterial species, it would be a great advance." He clings here to the theory of specificity as being the necessary *sine qua non*, and does not accept the probability, founded upon innumerable clinical observations, of an action indirect or other than directly specific, to account for the effect of para-specific therapy.

Diphtheritic antitoxin has been administered for disease of almost every anatomic segment of the eye, also for the different infections to which it is exposed, as well as for prophylactic purposes. It has been employed in dacryocystitis and phlegmon of the sac, recurrent styes, persistent ulcerative blepharitis, purulent and other types of conjunctivitis, including trachoma, purulent corneal ulcer, hypopyon keratitis and abscess of the cornea, interstitial keratitis, iritis (especially traumatic and purulent), iridocyclitis, abscess of vitreous, neuroretinitis, panophthalmitis and orbital phlegmon. Infections of the eye in which it has received most praise, include especially diphtheritic, pneumococcic and staphylococcic processes, whereas it has been tried out in all of them, particularly streptococcic, mixed infections, diplobacillary infection, influenza, syphilitic, gonorrhœal, and tubercular. For prophylactic purposes it has been used with varying degrees of speculation in cases of penetrating wounds, preoperative conditions with infection of the conjunctiva and lacrymal passages, glaucoma, traumatic cataract, etc., and following upon or incident to operative procedures of responsibility and of doubtful outcome. No statistics, however, bearing upon the efficacy of such measures have been published to my knowledge, but it has been urged on the theory of its curative value and upon the basis of its prophylactic influence from specific effects, as in the case of antitetanic serum therapy. An indication of some importance is that suggested by Darier, who emphasizes the benefits to be obtained by the early administration of antidiphtheritic serum, which is always available during the period in which a bacterial diagnosis is being made of a critically infectious condition. It is in these cases that early treatment is most needed, and to delay, while the bacterial diagnosis is being made and an autogenous or specific vaccine or serum is being prepared or procured, would lose valuable time in which perhaps irreparable damage and even loss of the globe may take place. Especially in penetrating wounds (traumatic or operative) with an infection evidently present from the clinical appearance, it is emphasized that early administration of antidiphtheritic serum may turn the tide of the process, before a specific serum or vaccine could be secured. Even then the virulence of autogenous or specific sera is so frivolous and uncertain in its preparation, dosage, and potency, that by the time it could be employed, it's specific properties may prove useless against a more advanced and more virulent process. Furthermore, in many instances specific serum or vaccine can not be had for many days, when the only treatment by that time indicated may be that of enucleation.

To record here the results from treatment with antidiphtheritic serum, as reported constantly by many authors during the past eleven years, would make too voluminous a narrative and is quite unnecessary as a point of information or of argument. It is of real importance, however, for a thorough understanding of the subject, to summarize these results both as effecting more directly certain anatomic segments than others, and as occurring in certain infections more profoundly and definitely than in others. Suffice it to say, regarding the former that the nonvascular structures,—cornea, aqueous, lens, and vitreous—seem to have received more attention and to have been more strikingly affected than involvement of the vascular elements of the eye,—lids, conjunctiva, orbit, and uvea. Many favorable results, which however may have been due to local and other treatment, are reported in infections of the vascular parts, but these have not been such as to compete with those obtained by specific sera, which of course combats an infection of the vascular structures of the eye in the same manner as that of the skin and vascular organs of the body. It is the involvement of the refractive media, nonvascular structure, which taken together form by far the greater part of the eyeball, and in which bacteria flourish in an unusual manner, that results from para-specific therapy would seem to claim an important place in ocular therapeutics. In cases of corneal ulcer and abscess, hypopyon keratitis and infections of the anterior segment from penetrating wounds and operative procedures, actual curative processes have been insisted upon, while in panophthalmitis and abscess of the vitreous, curative reactions and amelioration of symptoms have been noted by many clinical observers. Isolated instances of phlegmon of the orbit and of the vitreous entirely cured by para-specific therapy have been cited, but so unreasonably wonderful have been these results that their real significance can not be credited. In this connection Darier has repeatedly stated that para-specific serum therapy will not cure all ocular infections any more than antidiphtheritic serum will cure all diphtheritics, nor mercury will cure all syphilitics.

As to the character of the infection involved, staphylococcic and pneumococcic infections have shown the most marked effects from the serum. Streptococcic infections have not responded at all. Its effect upon syphilitic, gonorrhœal, and tubercular infections has not been consistent in any degree, although many reports of satisfactory results have been published. Where syphilis, gonorrhœa, or tuberculosis has been a complication of the pneumococcic or staphylococcic process in a nonvascular structure of the eye, the systemic condition has not seemed to prevent the usual effect of the serum upon the local infection.

CASES.

In my study and research of this question of para-specific therapy, I have been employing during the past two years the use of antidiphtheritic serum in many cases of severe ocular infection and have carefully observed almost daily the changes to be noted. I have also recorded a history of these cases, and a preliminary examination (appearance of the particular involvement in minute detail), as well as the course and treatment, including the dates of treatment and of definite changes in the pathological process. At this time I am able to report 30 cases—of which 23 are hypopyon keratitis, 2 infections of anterior chamber after penetrating wounds, 4 panophthalmitis, and 1 ulcus serpens.

These case histories appear in detail in the *Trans. Am. Ophth. Soc.*, for 1919.

ANALYSIS OF CASES.

In making an analysis of the cases reported above, I have striven to compile the data of all of them from the standpoint of the history, examination, serum treatment, other treatment, course, symptomatic effect and results, attempting to focus all the cases upon each point of consideration, so that a full understanding and appreciation of the effect, if any, of the serum can be studied and conclusions drawn in a clear and unbiased manner.

The first group of cases, hypopyon keratitis, twenty-three in number, are sufficiently varied in degree of severity and in extent of involvement, and are reported in sufficient detail to bear a close analysis. It is kept in mind, while studying each case, that the factors of systemic effect upon the local condition are of more real significance than those of purely local effects, but it is obviously a difficult task to judge in many instances whether the serum has had any effect, and if so, in what degree.

Of the 23 cases of hypopyon keratitis, 18 were over forty years of age, 13 of these over fifty years. Five cases were under forty years of age and three of these were over thirty. Of the five under forty years of age, four had systemic or local conditions which *influenced* the *vitality* of the cornea; Case XI, 31 years, had an exposed cornea since childhood when his face and lids were severely burned; Case XIV, 39 years, had a 4 plus Wassermann; Case XV, 32 years, had a neglected injury of a month's standing; and Case XXII was that of a phlyctenular diathesis. The only clear cut case in which lowered corneal resistance can not be accounted for was that of Case XIII, 14 years of age, and in this case there was no increase in corneal destruction, though active over a period of 1 month, 12 days in hospital. This bears out the usual history of these cases, for it is well known that hypopyon keratitis is much more common in the aged and among debilitated individuals following upon the neglect of a local injury. In all the cases but one, a local injury was admitted, and this originated from a pustule of phlyctenular keratitis, Case XXII. The period of involvement previous to admission to hospital varied as follows: 10 in less than a week, 4 in one week's time, 4 in 2 weeks', 3 in 3 weeks', and 5 in more than 3 weeks' time.

If one studies the processes of ulceration in these cases, it is noticed that the center or near center of the cornea is involved in every case, this being the area least protected by systemic resistance, furthest from the source of nourishment (the blood). All the cases had a deep involvement of the cornea, which type usually of itself is capable of producing hypopyon. The ulcers varied greatly in size from 1½ by *2mm* to that of three quarters of the entire corneal surface. The majority of cases had an undermining of the margins of the ulcer and a periulcerative zone of infiltration characterizing the severity and progress of the infection in the individual case. This was also true of the conjunctival and iritic reaction, and in six cases definite iritic involvement complicated the hypopyon keratitis, Cases II, III, VI, XIV, XVII, and XXI. Depth of hypopyon varied from a mere line to *6mm*, the majority being about *2mm* deep. The pneumococcus was the prevailing organism in almost every case; in one case (VII), the staphylococcus was found to be the infecting germ; in several cases no organism was isolated or cultures failed to be made. Two cases (XIV and XVII) were complicated by syphilis.

As for treatment, similar local treatment was employed in all the cases—hot fomentations of boric acid solution where there was little danger of perforation, hot salt solution irrigations where perforation was present or imminent, bichloride vaseline (1–5000), atropine, a dressing, and bandage. The cautery employed was in every case chemical, bichloride (1–500) in less critical cases, and carbolic acid (conc.) in those most progressive and destructive in character. Bichloride was used in five cases, carbolic acid in sixteen. Instead of the Saemisch transfixion, multiple incisions through the base and margins of the ulcer were made, sometimes perforation taking place with part or complete evacuation of the aqueous and hypopyon, really amounting to a Saemisch, though in the majority of instances perforation did not take place, no attempt however being made to prevent it at this time. These incisions were made according to the method of Verhoeff in opening up an ulcerated area. With a fine La Grange knife, the blade is held with the cutting edge forward, and the tissue is divided by a forward and upward movement of the knife, each incision passing through the margin and base of the ulcer. This was performed in 16 cases, 4 of which perforated at the time of operation. Serum treatment was administered early (within 4 days) in 6 cases, within 1 week to 10 days in 6 cases, within 2 weeks or more in 11 cases. The dose varied with the severity and extent of the infection in the individual case, larger doses being given in the first six cases for one or two doses, smaller doses being used in the last 17 cases but given more frequently. The largest single dose was 5000 units, repeated in 3 days. The smallest single doze was 500 units, repeated every other day for several days (and which seemed to be effectual, Case VIII). The average dose and one most often employed was that of 2000 units followed every other day by 1000 units for four doses or less as the case demanded. The interval between doses varied from every other day to a week, in one case (XVIII) eight days intervened, and in another case (XIV) seventeen days intervened. The number of injections depended usually upon the size of the dose and the chronicity of the involvement. One injection was sufficient in one case (XXII), twelve injections were necessary in another case (XIII), three or four injections being the average number required in the majority of the cases. The amount of serum given in a single case varied greatly, ranging from 2000 to 11000 units.

Of the most importance in this analysis is the study and comparison of the course of events in these cases following treatment as outlined above. The earliest time after injection, when the first change in the process of infection was noted, was 12 hours, when hypopyon of 1½*mm* disappeared after an injection of 1000 units, in Case XXII. The usual time intervening after an injection before a change could be noted was 24 hours, 48 hours almost invariably registering a well-marked improvement. Relief of symptoms, pain, conjunctival reaction, and iritic injection was constantly significant in 48 hours and sometimes in 24 hours following the initial serum injection. Hypopyon, promptly in 24 to 48 hours, was definitely reduced in amount or disappeared in all the cases except Cases XIV and XVII, these being syphilitic. Hypopyon disappeared slowly in four cases only; of these, two were syphilitic (cases XIV, XVII) and two with deep hypopyon (VII and XVIII). Hypopyon persisted without regard to injection of the serum only in the two syphilitic cases, but on the administration of mixed treatment rapidly disappeared. Hypopyon reappeared in seven cases, I, X, XIII, XIV, XVI, XVIII, XXIII, and disappeared promptly within 24 to 48 hours after injection of the serum in each case except Case XIV, who was syphilitic and this hypopyon yielded rapidly to mixed treatment. The iris was more or less involved in every case but more decidedly so at the initial dose of serum in Cases II, III, VI, XIV, and XVII, and responded to the injection by dilatation, freeing of synechia, and reduced reaction, except in Cases XIV and XVII, (syphilitics). As to the process of healing, I believe it is obvious that this was usually rapid, but more important still was the manner in which healing took place. There was noticed, not only in the less severe but the most severe cases, a rapid clearing away of ulcer debris such as does not usually occur in these cases, and especially of note was the transparency of the remaining not yet healed corneal tissue, the ulcer itself taking on a clear and clean appearance early in the process of repair. In the most severe cases, with penetration and collapse of the anterior chamber, there was present in the ulcerated area a blood-suffused mass, which in 48 hours more was shedding debris from process of repair. Time required for hospital care after injection varied greatly, of course, but was commonly from ten days to three weeks, the shortest time being four days (Case XXII) and the longest, five weeks (Cases X and XIII).

Now to summarize this analysis one must necessarily view the effects and relative results of this treatment. As to the rapidity of effect, it is hardly worth while to recall the many instances related above except to point out Cases XIV and XVII where there appeared to be little or no effect and where syphilis complicated. The result of a rapidly healing and clearing away of ulcer debris left surprisingly mild opacities and in many instances vision obtained was far beyond expectations, as in Cases II, V, VII, XII, XVI, XIX, XXII, and XXIII. Those cases in which the usual treatment was administered over a long period of time and without result, and which responded promptly to injection of the serum, were Cases, III, VI, VII, VIII, IX, X, XIII, XV, and XXII. Cases in which a definite relationship appears between injection and pathological change and indicative of a pronounced systemic effect were I, II, III, IV, X, XII, XIII, XIV, XVI, XVIII, XXII, and XXIII.

Analysis of the second group of cases (B. I and II), Penetrating Wound of Cornea with infection of anterior chamber, resolves itself into the following conclusions: The course and response to treatment with preservation of the globe and useful vision obtained in each case, must be admitted to be quite contrary to the usual course of events in this type of case. I believe in case B. II that panophthalmitis was averted. Could it have been due to the serum therapy of 5000 units?

Analysis of the third group of cases (C. I, II, III, IV), Panophthalmitis, is of greater significance than it would seem at first glance. It was Aristotle who said: "That which is destroyed and can not be avoided, ceases to be of interest." The mere presence of an abscess or purulent infection of the vitreous, is sufficient in itself that the eye is beyond repair, and therefore the matter of vision and even preservation of the globe "ceases to be of interest." But so far as the observation of the effects of antidiphtheritic serum upon the usual course and symptoms of the cases is concerned, it becomes a matter not only of interest, but one definitely expressive of the systemic effect of the serum upon an infectious process. While cure was not remotely anticipated, and not at any time was there any evidence of it, there was on the other hand evidence of curative properties in the serum, for in every case symptoms, both objective and subjective, subsided, and the infection rapidly became one of a quiet, mildly virulent type, entirely opposite to the usual course of events. Because the serum did not cure the panophthalmitis, restore the globe and some vision, can it be ruled out and be regarded as having no curative properties? Roemer says, "Anyone who regards the word serum as a miracle, is suffering under an illusion!" And yet Axenfeld concludes in his experiments on rabbits, that since the eyes went on to panophthalmitis and the animals died after injections of pneumococci into the vitreous, that the serum has no general or local effect.

The last case, D. I., Ulcer Serpens is reported in order to show that where every therapeutic means at our disposal is demanded of us and is employed, one may prevent a catastrophe.

THEORY OF EFFECT.

It seems to me unfortunate that the subject of para-specific therapy has been too excitedly and unreservedly presented to the profession, and by men, whose enthusiasm over what they observed clinically, led them to herald the serum in the very beginning of its development, as a "cure-all" of all infections regardless of a bacteriological diagnosis. Reports of "remarkable cures" by Deutschmann and his followers made it worse, for many of them were based upon opposing fundamental principles of pathology and bacteriology. So that wholly unreasonable results and reports and theories have together made the real value of para-specific therapy difficult of recognition. It must be remembered, however, that this therapy was not born of one man or two, but of a number, working along similar lines in different countries and with different products as a para-specific agent, each wholly unaware for a time (1905 to 1907) that the same theory was being studied by his contemporary. Moreover, the whole theory of resistance and immunity during the past ten years has become more and more complicated, the more is learned about specificity, foreign proteins, activating elements of human serum, blood-cell energy, and the "kinetic" and other forces of internal secretion.

Is it a fair judgment to conclude from experiments on animals similarly infected, that in man the serum is without value? And is it a fair conclusion from purely clinical observations on cases in which intensive local treatment has also been employed, that the serum has real curative properties? This seems to me to be the crux of the situation and leaves the question in the open, with more confusion than should be, until sufficiently reliable and carefully studied history and case reports are forthcoming. And is it not true that, early in the course of an ocular infection and especially in hypopyon keratitis, the case is treated from the local standpoint too exclusively as a rule? It is astonishing how many complications (systemic) occur among these cases, for example, poor conditions of nourishment, environment, and systematic care, gastrointestinal disturbances, dyscrasias, cardio-vascular, nephritic, tubercular, syphilitic, etc. All the more, therefore, it seems to me, it behooves one to study the systemic factor in the individual case.

For these reasons and others, it has occurred to me that if one first establishes the necessity of a systemic influence in hypopyon keratitis, for the moment disregarding the virulence of the infecting organism, and then can show that there is a curative response in the infectious process to a systemic influence (serum injection), one can logically deduct that there are curative properties in the serum against the infection. With this in mind, I wish to enumerate the following observations in support of the first premise, namely that, a *systemic influence* is *present* in *hypopyon keratitis*.

1. Age is commonly past middle life.
2. Environment is usually poor and one without care.
3. Type of the undernourished.
4. Majority show some form of debilitation.
5. Primary ulcer cases.
6. Phlyctenular pustule especially.
7. Center of cornea commonly the site of deep involvement (furthest from source of nourishment).

8. Many disease complications (T. B., syphilis, nephritis, dyscrasias, etc.).

9. Many others commonly admitted.

In support of the second premise, namely that, a *curative response* in the *infectious process* follows a *systemic effect* from *serum injection*, the following evidence is given.

1. Innumerable case reports from the literature show a definite response to injections of the serum as outlined above.

2. Check in progress of the infectious process in 24 hours after an injection as noted in my series of cases.

3. Relief of symptoms (pain, conjunctival and iritic reaction) in 24 to 48 hours following a dose of the serum.

4. Prompt diminution or disappearance of hypopyon in 24 to 48 hours after injection in every case reported in my series except two (these syphilitic).

5. Hypopyon returned on lapse of serum treatment and as promptly disappeared on injection of serum, as reported in 7 cases, I, X, XIII, XIV, XVI, XVIII, and XXIII.

6. Iris attachments responded to the injection in all cases except the two cases of syphilis, which responded rapidly to mixed treatment.

7. Healing process and the manner of clearing away of ulcer debris, leaving transparent corneal substance early in the process of repair, almost as distinctly noticeable a factor as the disappearance of hypopyon.

8. Rapidity of effect must be accepted.

9. Nine cases, III, VI, VII, VIII, IX, X, XIII, XV, and XXII, show response to injection immediately, although no change could be noted from previous long continued treatment.

10. Unusual effect upon cases of penetrating wounds, and especially that of purulent infection of the anterior chamber, Case B. II.

11. The resistance and defense of the tissues against the infection as demonstrated by the course and treatment of the four cases of panophthalmitis reported.

The conclusion necessarily follows that antidiphtheritic serum possesses curative properties against pneumococcic infections of the nonvascular (refractive) structures of the eye. It is of course impossible to furnish absolute proof, nor do I propose that this conclusion is absolute, in so far as the serum being the cure is concerned or in any way the whole cure of these infections. On the other hand, local treatment is just as essential as the serum treatment, but that the systemic factor always present in every serious ocular infection must be met by serum or other treatment, as the case demands, is to my reasoning essential. In the two syphilitic cases cited above, the effect of the serum showed definite limitations, even to no effect, until mixed treatment was administered, whereas in all the other cases improvement was noted following injection of the serum, intensive local treatment being employed. Furthermore, many cases of my series, III, VI, VII, VIII, IX, X, XIII, XV, and XXII, showed definite and rapid improvement and cure, where previous to the serum injection long-continued local treatment had produced little or no effect. Case XXII especially is so indicative, particularly since this case had the accepted systemic disturbance of a phlyctenular conjunctivitis. Tuberculin had not been accepted as a valuable agent in ophthalmic therapeutics until recently, and it is not now regarded by the bacteriologist or general practitioner as of much practical value in general medicine. In fact the acceptance of its efficacy in ophthalmology now is based upon carefully studied clinical observations constantly repeated, and not at all upon experiments made on animals. Roemer's pneumococcic serum is admittedly bactericidal in effect and has curative properties, as Axenfeld admits, and yet R. Solm found no effect of the serum when experimenting on animals, while its effect in man was definitely curative. Is it to be expected then that in the face of clinical results with anti-diphtheritic serum, its apparent curative properties in man should be ruled out because of negative experimental results on animals? As for para-specificity, it came when the theory of immunity tended more and more to greater specificity, for the strains of pneumococci and menigococci, etc., act well against their particular strain of organism, one strain of the same organism being apparently ineffective or not as effective against another strain, so that the shock of nonspecificity was more abrupt than it otherwise would have been, so narrow had become the one idea of specificity of strain against strain in both passive and active immunity. Antitetanic serum, because it was not sufficiently and definitely curative in its effect, threatened for a long time to be lost as one of the most valuable of prophylactic agencies, when its real value was being put to the test through tireless experiments and clinical observations, because it did not meet the full bacteriologic and therapeutic laws required for a cure.

The theory of how antidiphtheritic serum effects are exerted against nonspecific infections of the eye has been variously explained by the exponents of this therapy. Darier contends that strong toxins, such as antidiphtheritic or tetanus toxin, excite all the organs of the body to the production of antibodies of all kinds, not merely to the production of diphtheritic antitoxins, thus making the serum effective in all kinds of infection. It is well known that Loeffler first pointed out that the normal cornea shares in general bacterial immunity; Roemer has shown it to be true of pneumococci; and Ehrlich and Roemer proved it in regard to antitoxic immunity to the toxin of diphtheria. It is also recognized through the work of A. Leber, Roemer, Zur Nedden, and others, that receptors of the 1st order (antitoxins, agglutinins, and precipitins) pass in small quantities from the blood into the aqueous humor; on the other hand receptors of the 3d order (bactericidal substances, opsonins, hæmolysins, and cytotoxins) do not at all pass normally into the aqueous. The entrance of the latter into the aqueous has been proved after penetration, or irritation by injection or heating or chemical effects, and particularly in the presence of an inflammation. The vitreous is believed to share so slightly in any kind of immunity that, except under subconjunctival injections or violent inflammations is there any evidence at all of the presence of immune bodies. Lawford states that immunity on the part of nonvascular structures of the eye has not been confirmed; that the immunity possessed by the aqueous and vitreous is almost negligible, and even by all known means of increasing this immunity it cannot be brought up to the blood serum. He concluded that, with the exception of antidiphtheritic serum alone, therapeutic sera, both bactericidal and antitoxic, have been disappointing. He also points out that active immunization (vaccines) requires so much time that the process is not suited to an acute inflammation, although the immunity is more lasting. On the other hand, passive immunization (serums) has an effect that is immediate but transient. Is it not probable that since specific sera are known to act efficaciously in the vascular structures, and not with the constancy that para-specific sera act upon nonvascular structures, there is a reason here in the anatomic structure that may be explanatory of a theory not yet understood to account for the therapeutic effect of antidiphtheritic serum upon nonspecific infections of the refractive media? What is the change, anatomic, cellular, or chemical, that takes place in the cornea and aqueous and adjacent structures, and causes the absorption of hypopyon of 1½*mm* deep in 24 hours after an injection of 2000 units of antidiphtheritic serum? The abrupt disappearance of hypopyon is one of the most unmistakable and distinctive changes that is noted in an infectious process affected by serum injection. Therefore to advance a theory that would satisfy this hypothesis should come reasonably near the solution of the effect of the serum. The composition of hypopyon is well known. In process of its formation it is believed to be an element of protection, defensive in the course of the combat, and is always significant of danger of deeper involvement or progress of the infection. That its disappearance is due to and significant of improvement in the invading process should be reasonable ground, therefore, upon which to base a curative cause for the improvement. One must keep in mind that hypopyon may disappear spontaneously without treatment, in which case it is believed to be due to the natural forces of the tissues to overcome an enemy of weaker virulence. Again it may disappear under simple local stimulative measures, when it is concluded that the natural forces by the aid of local treatment checked the invasion of an infection more virulent than the natural forces of the tissues can alone combat. Also it may disappear after local stimulation and removal of the contents of the infected area or by cauterization of it, when it is reasonable to believe that these measures directly applied gives the advantage to the natural forces of the tissues to overcome an infection whose virulence is far superior to the normal resistance of the particular individual. And so one observes that, by numerous means of increasing or stimulating the natural forces of defense, and by means of attacking the infection by direct removal or killing of the bacteria, or by weakening their virulence, hypopyon disappears and repair is forthcoming. The following questions now arise: (1) Does the serum increase the natural forces of resistance? (2) Is the serum bactericidal? (3) Does it weaken the virulence of the invading organism? That the serum does produce a vital resistance is quite reasonable and is the theory usually advocated. There is certain evidence that there is a systemic element in the cause and effect of hypopyon keratitis, and the injection produces rapid improvement in the process. Whether hyperactivity of all the organs and tissues of the body and the production of antibodies with nonspecific properties is the full explanation of this effect is open to further experimentation and study. It is quite possible that the "vital energy of the tissues," so termed, may be another name for the foreign protein effect of the horse serum, regardless of the diphtheritic elements present. Piccaluga (Turin) refers to normal horse serum as possessing an hemolytic, agglutinating, and bactericidal action, as demonstrated by practical results and obtained by many experiments (Paton, Pes), and therefore concludes that in the horse there is a superproduction of elements of defense (receptors) that stimulate artificially the organism with the very virulent toxins, such as diphtheria. From the manner in which hypopyon is affected, the corneal infiltrates cleared, and ulcer debris cleaned away, it has occurred to me that there may be a determining factor of local resistance as the result of increased irrigation of the anterior segment of the eye, through a vasomotor or other effect, thereby supplying new and more highly activating leucocytes and other elements, if not increasing their number at one time, would increase their number over a given period of time. Clinical observation only lends some evidence in this direction, but further study of the physiological action of the serum, certain anatomic changes, and the local effect upon intraocular tension are necessary in order to substantiate this.

From our knowledge of bacterial processes and our study of immunization one cannot, without great reserve, believe that antidiphtheritic serum may exert a nonspecific influence against an ocular infection by the action of its contained antidiphtheritic specific elements against the bacteria of the invading process. That it has a bactericidal action is improbable, for almost invariably it is necessary to apply surgical means by relieving an abscess or undermined margins of a deep ulcer, or cauterization, antiseptics, etc., in order to directly destroy the organism, and without which treatment the serum may not be in itself able to combat the infection.

That the serum may possess, through its diphtheritic potency and foreign protein effect, a means of reducing the virulence of nonspecific bacteria or inhibiting their growth is a factor of importance, but obviously difficult to prove. The fact that other para-specific therapy has shown similar results and these results so rapidly brought about, lends some evidence in this direction. And it seems reasonable to suppose that there is an effect directly antagonistic as well as systemic, to account for such distinctive changes as are reported. Whether this is due to a phagocytic, hemolytic, or chemotactic action, or whether by the production of nonspecific antibodies, highly poisonous or antagonistic to pneumococci, a reduction in the virulence of the infection *is* brought about and is worthy of consideration and further study. A factor in favor of this theory may be noted in the four cases of panophthalmitis reported in which a reduced virulence seems likely.

To what extent can one depend upon antidiphtheritic serum as a para-specific remedy? From our experiments clinically it would seem unreasonable to expect such a definite specific or bactericidal effect as would make it unnecessary to administer local treatment. Many cases argue decidedly against this theory. Not only are intensive local antiseptic measures essential, but also early and precise surgical means should be employed as the individual case demands. That these additions to the treatment of pneumococcic infections are demanded does not at all take away from the importance of the serum treatment, for no therapy, however efficacious, is always sufficient alone to cure. Para-specific therapy is not in any sense a "cure-all," but because it is not does not detract from its curative properties. Where the knife or the galvanic or other cautery is indicated, it should be employed regardless of any reliance upon serum therapy. But, on the other hand, where the case is seen early and serum injected, cautery or Saemisch may be prevented, due to an early checking of the disease process. Herein lies its most important therapeutic value. And, furthermore, where the process of involvement is advanced, and the cautery or knife is indicated, early relief of pain and diminished reaction follows, as does also a rapid clearing away of ulcer debris, and final opacity of the cornea is reduced. The effect upon vision obviously is a question only of early control of the infection, rapid repair and clearing of the cornea, so that should one feel justified in relying upon antidiphtheritic serum in this regard, it can be administered before extensive destructive changes take place, and thereby be a means not only of improving but saving vision in the individual case. One does not reasonably expect the serum to alone overcome a virulent hypopyon keratitis, any more than one would look for a cure of dacryocystitis, even of a low virulent organism and treated by strong antiseptic measures with high tissue resistance, if the mechanical factor is not removed by the establishment of drainage into the nose. In the same manner proper drainage of the cornea and anterior chamber is necessary, where conditions of high virulence of the organism or an advanced process are present. The action of argyrol is known not to be bactericidal or even antiseptic as regards certain microörganisms, but its usefulness in infection is undisputed and its real effect was observed and worked out after its value was established clinically. The efficacy of antidiphtheritic serum in ocular infections is like the splint to a broken bone. The splint, though curative in its effect, may be ineffective when conditions of restlessness are present, where a bit of bone or periostium interposes as a foreign body, or specific disease, anemia, etc., may prevent healing; a cure may be finally secured through other surgical and medical therapy.

A question of special interest and importance is that of the time of administration and the dosage. I believe when more is learned of para-specific therapy, a clearer understanding of this question will give more definitely striking results. The relationship between the time of administration and the time of other treatment is of value, especially as to perforation of the anterior chamber, cauterization, hot applications, subconjunctival injections, etc. It is quite evident that the effect of an injection is transient as demonstrated by the return of hypopyon when the interval between injections was three to four days. It would be valuable to know during what time after the injection the effect of the serum is most potent, so as to time other treatment. The interval between injections and the dosage to be given also presents an important relationship. My experience and that of others tends to show that 2000 units, repeated every other day, or 2000 units as an initial dose, followed daily by 1000 units for 3 or 4 doses, seems to be as efficacious as larger doses infrequently administered. And yet 1000 units alone may act remarkably upon a most resisting process, as Case XXII will certify, and similarly one dose of 5000 units affects a case in the same definite manner (I, II, III, and IV). The long period of involvement previous to the beginning of treatment must not be overlooked, for the direct effect of the serum is such that it would seem as though the tissues had already established a high local resistance and one injection checks the infection in 24 to 48 hours. In cases where the involvement is recent the infection does not advance after 48 hours, as a rule, and soon there appears evidence of repair of the tissues.

It is therefore quite probable that, with more constant and numerous effects of serum treatment and with more light upon the subject of administration and dosage in relationship to the stage of the infectious process and the time of other treatment, one may prescribe antidiphtheritic serum with more confidence in the effect than at this time it is possible to have. Its prophylactic effect, if any, can not be fairly or at all judged by previous experiments or clinical observations, for it is obvious that innumerable experiments and long research must be made for this purpose, in order to draw comparative statistical results of any value.

CONCLUSIONS.

1. Literature on para-specific therapy is an interesting study and research, and clinical reports of wide experience point toward a field worthy of being explored.
2. Favorable results with para-specific therapy are by far in the majority over unfavorable reports.
3. Antidiphtheritic serum seems to have an advantage over other para-specific agents, because it is readily obtained, its dosage is more certain and the preparation more dependable.
4. It has the advantage over specific serum and vaccines

in that it can be utilized during the time when a bacterial diagnosis is being made and the special vaccine or serum is being prepared.

5. Indications are: In all severe infections due to the pneumococcus and staphylococcus, especially hypopyon keratitis, phlyctenular pustule, penetrating wound with infection, critical ulcer of cornea, postoperative infection, and panophthalmitis.

6. It should be administered early in the course of the infection, though its effect in the late stages is even more striking than in earlier involvement.

7. Administration by hypodermic seems theoretically more practical, though its use by mouth has been strongly advocated, with results equally as good.

8. Dosage is 5000 to 2000 units, the former infrequently repeated, the latter every day for 3 or 4 doses.

9. Adverse effects seem to have been of no importance.

10. Its principal effect is probably systemic, and to some extent reduces the virulence of the invading organism through the production of antibodies.

11. Its curative properties are demonstrated by the prompt effect upon hypopyon, reduction in conjunctival and iritic reaction, clearing away of ulcer debris, and relief of pain.

12. Its effect is limited by the presence of syphilis, untreated, and also probably by other systemic conditions.

13. It cannot be depended upon solely to combat an infection, though it may be the principal means of affecting a cure. Local measures, as indicated, are essential.

14. The time of injection in relation to the stage of involvement and the time of employment of other treatment may become a matter of special consideration and value when more is learned about para-specific therapy.

15. The prophylactic use of antidiphtheritic serum at this time is only problematic.

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REPORT ON THE TEACHING AND EXAMINATION OF MEDICAL STUDENTS IN OPHTHALMOLOGY.

COUNCIL OF BRITISH OPHTHALMOLOGISTS.

1. *Permanent Members:*

Being the Presidents (past and present) of the Ophthalmological Society of the United Kingdom, and of the Section of Ophthalmology of the Royal Society of Medicine.

Sir Anderson Critchett, Bt., C. V. O. (President)
Sir John Tweedy (Vice-President)
Mr. Priestley Smith (Vice-President)
Sir George Berry
Mr. F. Richardson Cross
Mr. J. B. Lawford (Treasurer)
Mr. W. Lang
Mr. E. Treacher Collins
Mr. J. B. Story
Mr. W. T. Holmes Spicer

2. *Elected Members:*

a. By the Ophthalmological Society of the United Kingdom:

Mr. J. Gray Clegg
Colonel J. Herbert Parsons
Mr. Stephen Mayou
Mr. A. B. Cridland

b. By the Section of Ophthalmology of the Royal Society of Medicine:

Mr. J. Herbert Fisher
Dr. George Mackay

Mr. W. G. Laws
Mr. Leslie Paton (Hon. Secretary)

c. By the Oxford Ophthalmological Congress:
Mr. P. H. Adams

The Council appointed the following:

Mr. J. B. Lawford (Chairman), Sir John Tweedy, Messrs. Collins, Mackay, Clegg, Adams, Mayou, and Paton to be a committee to consider the question of the teaching and examination of medical students in ophthalmology and to report to the Council on the steps that should be taken to improve this training.

The Council have considered the question of the teaching and examination in ophthalmology before qualification, and report as follows:

Part I.—Representations to the General Medical Council on the subject.

Part II.—Existing regulations concerning the teaching and examination in ophthalmology in the United Kingdom and abroad.

Part III.—The need for improved instruction of medical students in ophthalmology.

Part IV.—Summary of recommendations.

Part I.—Representations to the General Medical Council on the Subject.

By the courtesy of the General Medical Council the following information has been obtained.

In 1879, twenty-four prominent ophthalmic surgeons presented a petition to the General Medical Council advising a compulsory three months' course in practical ophthalmology for medical students, and pointing out to the Council the neglect of training in this subject as compared with Continental and Indian Universities. As the result of this petition the General Medical Council approached the various examining bodies in the United Kingdom, and subsequently made the following recommendation:

"With reference to ophthalmology, the opinion of the bodies is almost unanimous that, under the present arrangements of their respective examinations, the subject of ophthalmology receives its fair share of attention, and that it would not be desirable, either to require attendance on a special course of lectures on ophthalmology as part of the curriculum for a medical student, or to make ophthalmic surgery a distinct subject of examination (separate from surgery) at the Pass Examination for a License to practice. The Committee[1] see no reason to dissent from that opinion of the licensing bodies, and they accordingly do not advise the Council to recommend that a special course of study of ophthalmology, or a distinct examination in that subject, should be required."

On May 29, 1891, the Ophthalmological Society of the United Kingdom[2] presented a memorial to the General Medical Council in favor of including ophthalmic medicine and surgery in the ordinary curriculum. This was received by the Council, and entered on their minutes, but no further action was taken at the time.

On May 26, 1906, the General Medical Council approved a report of their Examination Committee that: "The Inspectors called attention to the circumstance that at some Boards no evidence of knowledge of ophthalmology was required."

On November 26, 1910, the General Medical Council adopted a report of their Education Committee as follows:

"In the curriculum of all the licensing bodies, with three exceptions, special courses on ophthalmology form an essential part. The Committee are of opinion that every student of medicine should receive some special instruction in the subject. The Committee do not think it necessary to insist that every student should be examined in ophthalmology, but they are of opinion that all students should be liable to be examined in some branch of the subject."

In 1911, a communication from the British Medical Association, asking that the study of ophthalmology should be made compulsory in the medical curriculum, was brought before the General Medical Council. In reply the attention of the British

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[1] *I.e.*, The Education Committee of the General Medical Council.

[2] *Trans. Oph. Soc. U. K.*, vol. xii., 1892, p. 225.

Medical Association was called to the report by the Education Committee in November, 1910, cited above.

Part II.—Existing Regulations Concerning the Teaching and Examination in Ophthalmology in the United Kingdom and Abroad.

The present condition of Ophthalmic Training and Examination in Great Britain and Abroad.

A circular letter was sent to the principal universities and other examining bodies at home and among the allied and neutral countries. In consequence of the war, the circular probably failed to reach some of those to whom it was addressed.

Answers have been received from twenty-two examining bodies in Great Britain and Ireland and from twenty-six colonial and foreign universities.

A. The Teaching and Examination in Ophthalmology in the United Kingdom.

(1) The requirements as to training are as follows:

a. No certificate of training in ophthalmology required.
    University of Oxford.
    University of Cambridge.

b. Ophthalmology one of four optional special subjects, certificates required for two only.
    The Society of Apothecaries of London.

c. A certificate of attendance at an ophthalmic clinic for three months required.
    University of London.
    "   " Liverpool.
    "   " Aberdeen.
    "   " Dublin. Trinity College.
    Queen's University of Belfast.
    Conjoint Board R.C.S. England and
        R.C.P. London.
    "   "   R.C.P. and S. Edinburgh and
        R.F.P. and S. Glasgow
            (13 attendances).
    "   "   R.C.P. and S. Ireland.

d. Certificates of attendance on a course of lectures and clinical instruction required.

University of Edinburgh.
" " Glasgow.
" " St. Andrews.
" " Wales.
" " Durham.
" " Birmingham.
" " Manchester.
" " Sheffield.
" " Bristol.
" " Leeds.
National University of Ireland.

(2) The methods of examination are as follows:

a. An occasional question in the surgery paper, or *viva voce;* the examiners not being ophthalmic surgeons.

University of Oxford.
" " Cambridge.
" " London.
" " Durham.
" " Leeds.
" " Sheffield.
" " Bristol.
" " Glasgow.
" " Aberdeen.
" " Wales.
Conjoint Exam. Board R.C.S. England and
R.C.P. London.
" " " R.C.P. and S. Edinburgh and
R.F.P.S. Glasgow.
Society of Apothecaries of London.

b. Special examination conducted by ophthalmic surgeons as part of the qualifying examination.

University of Dublin, Trinity College.
National University of Ireland.
Queen's University of Belfast.
Royal Coll. of Phys. and Surg. Ireland.

University of Liverpool.
" " Birmingham.
" " Manchester.

c. Class examinations. The certificates required before admission to the qualifying examination given only to students who attend a recognized course regularly and reach a defined standard in the class examinations.

University of Edinburgh.
" " St. Andrews. (Commencing 1919).

(The regulations under (*a*) also apply to these two universities.)

B. The Teaching and Examination in Ophthalmology in Colonial and Foreign Universities.

America. The report of the Carnegie Trust on Medical Education in America has been of great assistance to the Council in selecting the universities to which circulars should be sent.

United States.

University of Michigan, Ann Arbor.
Johns Hopkins University, Baltimore.
Harvard University, Boston.
Northwestern University, Chicago.
University of Illinois, Chicago.
Rush Medical College, University of Chicago.
Western Reserve University, Cleveland.
University of Kentucky, Louisville.
" and Bellevue Medical College, New York.
" " Columbia, New York.
" " Cornell, New York.
Yale University.

Canada.

McGill University, Montreal.
University of Toronto.

All the above, with the exception of the Northwestern University, Chicago, require students to attend both a course of lectures and a course of clinical instruction, and hold special examinations conducted by ophthalmic surgeons. The Northwestern University, Chicago, require a certificate of attendance on a course of clinical instruction in ophthalmology and there is no special examination.

France.

University of Paris.

Clinical course in fourth year. Certificate after examination.

University of Toulouse.

Clinical course of one term. Ophthalmology alternates with dermatology as a special subject in the qualifying examination.

University of Lyons.

Clinical course of one term.

University of Montpellier.

No certificates required.

Switzerland.

The State examination for a diploma to practice medicine includes an oral and practical examination in ophthalmology conducted by two ophthalmic surgeons.

University of Basle.

A course of lectures during two terms and a clinical course of three terms.

University of Lausanne.

Clinical course of one term.

Spain.

Central University of Madrid.

Course of 82 lectures and clinical attendance from October to May. Examination at the end of the course conducted by the Professor of Ophthalmology.

University of Barcelona.

Course of 68 lectures; otherwise exactly as Madrid.

Sweden.

The examination in ophthalmology is entirely practical and oral, and is conducted by the Professor.

University of Upsala.

A course of lectures and two months' clinical course.

Norway.

Viva-voce examination as in Sweden.

University of Christiana.

Clinical course of one term.

Denmark.

University of Copenhagen.

Clinical course twice weekly during one term.

Occasional question in the surgery paper in the qualifying examination.

Japan.

University of Kyoto.

A course of lectures and a clinical course.

The examination in ophthalmology is oral and is conducted by ophthalmic surgeons.

The above analysis shows that Great Britain stands almost alone in granting diplomas to practice medicine without evidence of an adequate knowledge of diseases of the eye. There are still three examining bodies which have not even adopted the recommendation of the General Medical Council of 1891, which requires a certificate of attendance at a three months' clinical course. Moreover, at other institutions the interpretation of what is meant by a three months' course varies greatly and should be more accurately defined, as it is by all the American universities.

In Great Britain only a small minority of the licensing bodies apply regularly a test of ophthalmic knowledge. In Ireland and in the great majority of foreign universities, ophthalmology is one of the subjects of the qualifying examinations and the examiners are invariably ophthalmic surgeons.

NOTE.—*Since going to press we have received information as to the requirements of the Indian Universities of Bombay, Madras, and the Punjab (Lahore). In all three cases attendance at a course of systematic lectures, and of clinical instruction during a period of three months, is required. There is a special examination in Ophthalmology, consisting of a written paper and a practical and oral examination conducted by two ophthalmic surgeons.*

Part III.—The Need for Improved Instruction of Medical Students in Ophthalmology.

In the opinion of the Council the knowledge of ophthalmology possessed by the majority of medical students in Great Britain at the time of their qualification is inadequate to enable them to diagnose and treat efficiently cases of ordinary eye diseases met with in general practice. In 1917, Sir Arthur Downes in the "Report of the Departmental Committee of the Local Government Board on the Welfare of the Blind" (p. 60) quoted, and endorsed as still applicable, the statement made in the memorial presented by the Ophthalmological Society of the United Kingdom to the General Medical Council, in 1891, that "it is notorious that the general body of the profession does not possess a competent knowledge of diseases of the eye." Unless further action is taken in the matter this reproach to the medical profession will continue.

The Council hold that it is desirable that the training in ophthalmology should be mainly clinical, and they agree that a period of three months is all that can be allotted to the subject in a five years' curriculum. They, therefore, recommend: (1) that attendance at an ophthalmic clinic for not less than six hours a week during a period of three months shall be required of every student; (2) that such a period of clinical training shall be supplemented by a course of systematic lectures or clinical classes.

A very serious defect in the existing regulations is the absence of any test of the student's knowledge of ophthalmology in the qualifying examinations. Teachers in the medical schools are well aware that without the stimulus of an examination many students give the least possible attention to ophthalmology and may, and often do, finish their training without gaining even a rudimentary knowledge of the subject. In the opinion of the Council, it is most desirable that an examination in ophthalmology should be made an integral part of the qualifying examination by all those licensing bodies which have not hitherto included it in their schedule.

Internal Students.—When an examining board deals only with students trained within its own walls the system adopted by the universities of Edinburgh and St. Andrews has the advantage of not adding to the burden of the qualifying examination. At the end of the course in ophthalmology there is a written and a practical examination, and certificates of admission to the qualifying examination are not granted to students unless they have attended the course regularly and have reached a definite standard in the class examinations.

The Council are of opinion that in such examinations, as in those for qualification, a second examiner should be associated with the teacher.

External Students.—A different problem confronts such examining boards as the universities of Oxford, Cambridge, and London, and the conjoint boards, which have to deal with students trained under diverse conditions in institutions over which the boards exercise little supervision. Such bodies should require definite evidence of regular attendance at an ophthalmic clinic and at a course of systematic instruction. In addition they should have a test that the student has acquired an adequate knowledge of the subject. The Council do not consider it essential that this test should be by a written examination, but they hold that there should always be a practical and oral examination in the diagnosis and treatment of the commoner diseases of the eye and in the use of the ophthalmoscope. Such an examination can only be carried out efficiently by ophthalmic surgeons who should also set and adjudicate on such ophthalmic questions as may be given in papers.

In the examination in ophthalmology, as in the examinations in pathology, surgical anatomy, etc., a candidate who does not attain to the required standard must be held to have failed to qualify in surgery.

Part IV.—Summary of Recommendations.

The Council therefore make the following recommendations:

(1) No student shall be admitted to the final examination, qualifying to practice medicine, unless he has attended an ophthalmic clinic for not less than six hours a week during a period of three months, and has attended a course of systematic instruction in ophthalmology.

(2) No student shall be considered to have passed the qualifying examination unless he has shown a sound knowledge of practical ophthalmology in an examination conducted by ophthalmic surgeons.

REPORT OF THE ANNUAL CONGRESS OF THE OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM.

BY MR. H. DICKINSON, LONDON.

(*Concluded from the September number*)

THE BOWMAN LECTURE.

Plastic Operations on the Orbital Region.

Professor MORAX delivered the Bowman Lecture, taking as his subject **plastic operations on the orbital region,** including **reflection of the orbital cavity, eyebrows, and eyelids.** The author opened with a felicitous acknowledgment in the name of France of the high honor conferred on him, and through him on French ophthalmology, by asking him to deliver this lecture. He said the prime motive for wishing to restore the appearance of the face when functional disability was not present was the avoidance of the unsettling curiosity manifested by the people met in the street, with which must be coupled the fear that his obvious defect would cause a lessening of affection on the part of those he held in esteem. There should be avoidance of the use of tissues in the formation of a flap in the regions of motor nerves, and the utmost degree of asepsis must be insisted on. He found the skin surface was sufficiently sterilized by sterilized soap and tincture of iodine: any organisms remaining were generally saprophytic. Hairy flaps sometimes harbored saprophytic organisms, and these might afterwards cause little foci of suppurating folliculitis. It was necessary to devise a method of securing more perfect sterilization of hairy flaps. When the conjunctival mucous membrane was alone at stake, one usually succeeded with physiological salt solutions, with instillations of zinc sulphate or silver nitrate. It was easier for the lacrimal mucous membrane to be a source of infection. Some failures in this region had been due to operations having been done when there was latent dacryocystitis; and in such cases the extirpation of the lacrimal sac and its diverticula would alone be efficacious, the lacrimal canaliculi being excised. With regard to the destruction of eyebrows, by burning or the explosion of powder, when only one brow has been involved, it was easy to detach half its breadth, leaving a nasal pedicle, then fixing the isolated flap in an incision made symmetrically on a level with the upper margin of the orbit. When both eyebrows are destroyed, there must be recourse to non-pedicled hairy flaps, and these were less certain in results. He used for these cases flaps from the occipital region, fixing them in position by several mattress sutures. One disadvantage was that the hair on the new flap grew rapidly, and one of his cases had to have his eyebrow cut when he went to the barber's.

With regard to repairs to the eyelids, an extensive cutaneous destruction on a level with the lids was followed by an obvious modification of the palpebral fissure, and the mutilation would be even greater when it involved skin and subjacent tissues, muscle, etc. The first act in such cases must be to bring together the margins of the two lids, after having freshened the mucous margins in the usual way. In most cases, the union of the lids must be maintained for two or three months. Professor Morax entered into the technique in detail.

He proceeded to speak of repairs to the orbital cavity. When the wound received involved total or partial destruction of the eyeball and its mucous membrane, there was a shrinking scar of the orbit, and more or less complete adherence of the lid tissue to the orbital tissue, and these symblephara prevented the wearing of an artificial eye. Sometimes enucleation had been done by a surgeon who did not appreciate the importance of conserving every bit of mucous membrane. One must wait until the process of scar formation had been consolidated and there were no more signs of infection, before attempting to graft. Whenever possible, one had recourse to cutaneous pedicle flaps taken from the neighborhood. He described various types of case, and the procedures adopted.

With regard to complete symblepharon, if all the mucous membrane was destroyed, the method described would have to be modified. He had found it best to openly expose the parts to be grafted, and keep them open until the graft was in good condition. In some cases it might be necessary to combine the dermo-epidermic grafting method with the pedicled flap one in total symblepharon. Professor Morax concluded by describing his methods of securing a mobile support for an artificial eye.

Eyesight and Education.

On Friday morning, at the Royal Society of Medicine, an interesting discussion took place on the subject of **eyesight in connection with education.** It was opened by Dr. JAMES KERR who said that at the present time any examination of the relations between vision and education rested much on the testing for acuity at school, while such matters as fatigue, functional troubles, the ocular results of various kinds of work, and the risks of visual deterioration were scarcely noted by those having the oversight of education. The use of the Ives grating and testing each eye separately did not yield fair results: the second tested eye usually gave the worst record, and he had now abandoned the method. He much preferred the copying of test types by children using both eyes, as this gave practically all the results required, and there was no waste of time. The results also provided a good basis for mass investigations. The tables in the earlier Board of Education Reports showed a great variation according to the districts concerned: *e. g.*, 19.5% with bad vision in Newcastle to 4.4% at Ashton-under-Lyne; 11.3% Lancashire, 4.8% Gloucestershire. By careful testing of very young children with test types, Dr. Margaret Hogarth got 86% normal vision in 800 infants, and only 3.2% cases of bad vision; she took every precaution to keep the attention fixed, and introduced a number of refinements. The local variations involved national problems, and were due, no doubt, largely to preventible causes, but there had not been any investigation on the question. He considered they were closely related to the general surroundings and were closely connected with the general health. The results in eye testing were largely influenced by the condition of the general cerebral cortex. Fatigue was important in academic work, and ocular fatigue, though masked by great accommodative range in the young, was a contributor to nerve fatigue. With regard to myopia, four fifths of the children passed through all the strains and troubles of school life ocularly unharmed, but the majority who suffered from it became myopic. The increase of myopia year by year of age was not correlated to education, but to age. In a large number of cases Inglis Pollock showed that up to the fourteenth year 7% to 8% were myopic, but after that age it jumped to 15% to 19%, and remained above that figure. About puberty there was a real increase in the myopia present, also during the convalescence following acute illness. Sweden, by adopting classical education and Gothic print, had greatly increased the proportion of good vision in the country. He proceeded to emphasize the great importance in this connection of general nutrition. There should be careful measures to avoid glare and strong light contrasts, and children should be spared all unnecessary fatigue. He indicated the lines along which he thought further investigation should be carried.

Mr. N. Bishop Harman dealt with the clinical aspect of the subject, and he left out of account children who had attained to some stability of tissue and whose vision was good according to accepted standards. The remainder of the school population included (1) the immature; (2) the defective; (3) the blind.

With regard to class (1) the instability of accommodation and of binocular vision in early years was notorious, and this instability must extend to other functions. Owing to the intimate relation of brain and eye, the effect of any form of close work on the child was serious: to them, even the recognition of figures and letters was a mental feat, and he believed the eyes felt fatigued according to the degree of mental exertion. Adults had only to remember the ease with which they could skim over a novel for hours, yet felt fatigued by a comparatively short study of a scientific treatise. Yet the daily routine of the school child was comparable to the latter. When one read of the average work required of the average infant, one was led to inquire what was the average infant, but there was, as yet, no answer. No steps were taken to ascertain what the eyes of any particular infant were like nor whether its defects would render the child incapable of bearing up against the strain put upon them. Between the fourth and seventh years the infant went through a training at school without any medical eyesight examination. The refraction could always be measured. He had examined the refraction of all the infants in a high-grade school in the west of London. The eyes of each child were anointed with a fresh preparation of homatropine and cocaine in castor oil (2% of each), then the child was allowed to sleep for an hour. After the examination the eyes were anointed with a minute smear of 1% eserine in oil, to effect closure of the pupils as quickly as possible. Three hundred and sixty-eight children, of ages four to seven, were examined; only eight wore glasses. Only eight had emmetropic eyes, but there were 232 hypermetropes, viz., 130 under 1 D., seventy-three under 2 D., while those with not more than 3 D. were twenty-nine. There were thirty-eight who had more than 2 D. astigmatism. Only very few had myopia of any degree, though one child had 18 D. Seven had scarred eyes, twenty-three had anisometropia of over 1 D., while eight had squint. The summary of his conclusions was, that one in every three was not fit to do ordinary school work under ordinary conditions, results which were striking and unexpected. He strongly condemned the practice of submitting young infants to school work without a preliminary examination of their eyes. There should be a definite grading of the little ones at these early ages. Indeed, the subject was sufficiently serious to warrant its examination by a committee of this society. He concluded by a description of special methods, such as those seen by members at their visit that day to the schools at Camden Town and Hampstead Road.

The subject was discussed by Mr. HARRISON BUTLER, Mr. ERNEST CLARKE, Mr. PERCIVAL HAY, Mr. A. L. WHITEHEAD, Mr. INGLIS POLLOCK, Mr. EVANS, Mr. G. W. THOMPSON, and the openers replied.

On Friday evening a series of papers were read and discussed.

Mr. TREACHER COLLINS and Mr. LESLIE PATON contributed a paper on **angioma of the choroid.** The patient, a boy, first came under Mr. Paton's care in 1917, when he was fourteen years of age. There was a large nævus on the left cheek and outer side of left orbit. There was detachment of retina outwards and downwards. The tension of the eye was then normal. Puncture of the sclera was made with the galvanocautery, but the vision did not improve. A year later, an acute attack of glaucoma occurred, and the eye was removed. There was found to be a lens-shaped mass in the choroid, measuring 9*mm* in length, 4*mm* in breadth, extending from the upper margin of the optic disk to a little behind the equator. There were the typical appearances of cavernous angioma. In the partitions between the vascular spaces on its inner surface were well developed lamellæ of bone.

Mr. Ernest Clarke read a paper on **presbyopia**, a subject, which, in the author's opinion, had been very inefficiently treated in the past in the various textbooks. Presbyopia synchronized with important body changes. The "squeezability" of the lens decreased with age, and in the normal emmetrope, at forty-eight years of age, it had decreased to such an extent that the person was conscious of requiring aid for near work. This was not a disease, but a physiological change, which affected all eyes alike. He considered that true presbyopia was entirely dependent on the lens, not due to any weakness of ciliary muscle, except in advanced age. Presbyopia was felt most at the time when eye-strain was most liable to occur, and Leonard Williams and others had shown the dangers of hypothyroidism, especially in connection with intestinal poisoning, for when the thyroid gland was deficient, the gate was opened for the poisoning of the system by toxines. He advocated the wearing of bi-focal glasses; a mistake commonly made in these was to give a too strong reading addition to them.

Colonel Lister and Captain M. L. Hine contributed a paper on the condition of **evulsion of the optic nerve.** The authors had been able to find records of only twenty-two cases, and only four with a pathological report, yet during the war this condition of the optic disk had become familiar. It was recognized either by a hole at the optic disk, which might occupy the whole or a part of the scleral ring, or the disk might be filled apparently with white. In both cases the retinal vessels had either completely or partially disappeared. The tearing of the tissue resulted in gross hemorrhage at the back of the eye, so as to obscure the field for the ophthalmoscopic examination. When, as occasionally happened, little or no hemorrhage took place into the vitreous, the ophthalmoscopic picture was one of the most striking possible: a fundus oculi without vessels, an optic disk replaced by an apparently bottomless glaucomatous pit set in a background in which there were dramatic concussion changes. The paper gave a minute description of the changes found, and was supplemented by a number of colored pictures, shown by means of the epidiascope.

Mr. E. HENDERSON read brief notes of a rare form of bilateral choroidoretinitis in a young child. The child, æt. six years, was brought on account of occasional convergent strabismus of the left eye. After wearing correcting glasses and having the defective eye trained, the strabismus disappeared. Two and a half years later, the sight having deteriorated, there was found in the right eye, a brilliant white exudation to the macular side of the disk, in the center of which was a circular, partly pigmented patch. Some months later the left eye suddenly failed. A similar symmetrical patch was found in the fundus, but accompanied by widespread exudation, and surrounded by some hemorrhage. No source of infection could be found, and the Wassermann and tuberculin tests were negative. The scattered exudation gradually disappeared, and the appearance at present closely resembled that of the fundus of the other eye. He regarded the condition as due to some unexplained choroidal vascular lesion.

The following papers were also read:

Mr. ARNOLD LAWSON, (1) **a new method of applying radium in diseases of the eye** (in collaboration with Mr. Sidney Russ who described the rationale). (2) **Flavine in ophthalmic surgery.**

Saturday morning was devoted to a clinical meeting at the Central London Ophthalmic Hospital, when many cases of interest were exhibited and discussed.

During the Congress, members visited the Day School for the Blind, Brecknock Road, Camden Town, the Myopia School, Exmouth Street, N. W., and the Wellcome Museum, Wigmore Street. A dinner was held at the Welbeck Palace Hotel, and a museum of exhibits and specimens was established, under the care of Mr. R. R. James. On Saturday afternoon many members gladly participated in a golf match at Northwood.

BOOK NOTICE.

VII.—**Manual of Neuro-Surgery.**

Prepared under the direction of the Division of Surgery in collaboration with the Section of Head Surgery, General Surgery, Orthopedic Surgery, and Neuro-Psychiatry, the Army Neuro-Surgical Laboratories, and the Instruction Laboratory of the Army Medical Museum; under the Supervision of the Surgeon-General. Washington: Government Printing Office, 1919. Distribution limited to the officers in the Medical Corps of the Army and to libraries receiving government literature.

This is an octavo volume of 492 pages, written by thirty-one contributors. Most of the ophthalmological portion was published in THESE ARCHIVES, vol. xlvii., No. 3, 1918, with the title "The Eye in Nervous Disease," by Ward A. Holden.

The book as a whole is a concise and well-illustrated treatise dealing first with the anatomy and physiology and then continuing with the diseases and injuries of the nervous system, with special attention given to surgical treatment. Considerable space is devoted to the relation of the eye, the ear, and the nasal sinuses to nervous affections, and the ophthalmologist will find the volume a lucidly written, happily condensed, and thoroughly practical work of reference on Neurology.

W. A. H.

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